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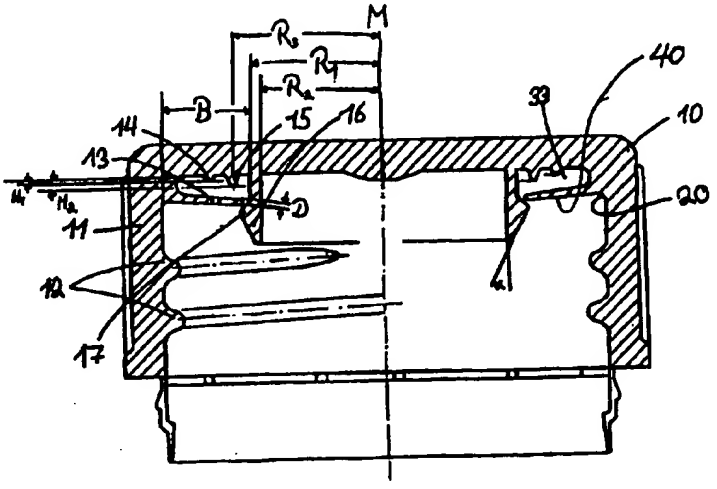

(57) Abstract

A sealing cap for releasably closing a container has a cap body matching the container to be sealed, a closing mechanism, which releasably seals the container and the cap body and a seal co-operating with an upper edge of the container in order to seal it when the closing mechanism is operated. In addition, the closing cap has at least one shoulder formed on the cap body which faces the upper edge of the container and with which the seal co-operates when the closing mechanism is actuated.

(57) Zusammenfassung

Eine Verschlußkappe zum lösbaren Verschließen eines Behälters, die einen Kappenkörper (10), der zu dem zu verschließenden Behälter paarig ausgebildet ist, einen Verschlußmechanismus (12), der den Behälter (100) mit dem Kappenkörper lösbar verschließt, und ein Dichtungsmittel (11), das mit einer Oberkante des Behälters zusammenwirkt, um diesen beim Verschließen des Verschlußmechanismuses abzudichten, aufweist. Weiterhin weist die Verschlußkappe wenigstens eine am Kappenkörper ausgebildete Schulter auf, die der Oberkante des Behälters gegenüberliegt und mit der das Dichtungsmittel zusammenwirkt, wenn der Verschlußmechanismus betätigt wird.

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Verschlußkappe

Die vorliegende Erfindung betrifft Verschlußkappen zum Verschließen von Behältern. Insbesondere betrifft die vorliegende Erfindung Schraubverschlüsse sowohl für Mehrwegflaschen (MW) und Einwegflaschen (EW) aus dem Material PET als auch für GDB-Flaschen, die kohlensäurehaltige Getränke enthalten.

Die folgende Erörterung des Anmeldungsgegenstandes und des Standes der Technik beschränkt sich auf Verschlußkappen zum Verschließen von GDB-Getränkeflaschen, um die Diskussion übersichtlich zu halten. Es wird jedoch ausdrücklich darauf hingewiesen, daß die vorliegende Erfindung nicht auf Verschlußkappen für GDB-Getränkeflaschen beschränkt ist, sondern sich für beliebige Arten von Behältern eignet, wie beispielsweise auch für Nahrungsmittelbehälter (sogenannte Tupper Ware). Ferner ist bevorzugterweise die erfindungsgemäße Verschlußkappe sowohl für Mehrwegflaschen (MW) als auch für Einwegflaschen (EW) aus dem Material PET verwendbar.

Verschlußkappen, mit denen Getränkeflaschen oder ähnliche Behälter verschlossen werden können, haben weite Verbreitung gefunden. Sie müssen dabei gemeinhin unterschiedliche Anforderungen erfüllen. Zum einen muß die Abdichtung der Getränkeflaschen bzw. Behälter derart erreicht werden, daß das in ihnen enthaltene Getränk im verschlossenen bzw. verriegelten Zustand nicht aus dem Behälter austreten kann. Handelt es sich bei den abzudichtenden Behältern um Flüssigkeiten enthaltende Flaschen, dann wird diese Anforderung durch die Viskosität der Flüssigkeit bestimmt. Sind die in den Flaschen enthaltenen Getränke

darüber hinaus mit einem unter Druck stehenden Gas wie z. B. Kohlensäure versetzt, dann muß die Abdichtung darüber hinaus auch gasdicht sein, um das Gas am Austritt aus der Flasche zu hindern.

Um die oben erwähnten Abdichtfunktionen zu erreichen, weisen Verschlußkappen nach dem Stand der Technik eine Vorrichtung zum Abdichten des Gefäßes oder Behälters auf. Eine bekannte Methode zum Abdichten besteht in der Verwendung eines elastischen Dichtungsringes, wie er zum Beispiel bei Einmachgläsern Verwendung findet. Bei diesem Verfahren werden Verschlußkappe und Dichtungsring separat hergestellt und nach der Herstellung zusammengefügt. Wie leicht zu ersehen ist, ist diese Methode durch Herstellung zweier Komponenten kostspielig und umständlich. Ein weiterer Nachteil dieser Methode ist aus der täglichen Anwendung bekannt: Der Gummiring verrutscht relativ leicht und verhindert dadurch die zuverlässige Abdichtung des Behälters.

Aus diesem Grund wurden bereits Dichtungsringe vorgeschlagen, die als integraler Bestandteil der Verschlußkappe ausgebildet worden sind, wodurch sich viele Vorteile ergeben.

Ein derartiges Beispiel ist aus der EP-A-0 580 369 bekannt, die einen solchen Einkomponenten-Flaschenverschluß betrifft. Die Verschlußkappe besitzt eine sich vom Kappenkörper nach innen erstreckende Dichtungslippe, die integraler Bestandteil der Verschlußkappe ist. Durch Aufschrauben der Verschlußkappe auf den Behälter wird die Dichtungslippe durch die Oberseite des Flaschenhalses gegen die Innenoberfläche der Verschlußkappe gedrückt. Der Gegendruck der Innenoberfläche der Verschlußkappe führt zu einer gasdichten Abdichtung des Behälters durch die Dichtungslippe. Um ein Festkleben der Dichtungslippe an der Innenoberfläche der Verschlußkappe zu vermeiden, ist eine Mehrzahl von sich

radial nach innen erstreckenden Rinnen vorgesehen, die das Ankleben vermeiden sollen. In der EP-A-0 580 369 werden auch Abweichungen von den Toleranz-grenzen der Dichtungslippe und der Flaschenhals-dimensionen in Betracht gezogen.

Die Nachteile dieses bekannten Verfahrens liegen in dem eigentlichen Abdichten des Behälters: Im Idealfall steht der gasdichten Abdichtung des Behälters nichts im Wege, aber sobald die Oberkante des Behälters geringfügige Unebenheiten aufweist und keine vollkommen gleichmäßige Fläche besitzt, was vor allem bei Mehrwegflaschen durch häufige Benutzung wahrscheinlich ist, ist eine zufriedenstellende Abdichtung nicht mehr möglich. Darüber hinaus ist zu beachten, daß durch die Anordnung der radialen Rinnen bzw. Nuten an der Innenoberfläche der Verschlußkappe eine gleichmäßige Abdichtung nicht erreicht werden kann. An den Stellen, an denen an der Innenoberfläche der Verschlußkappe die Nuten liegen, wird die gewünschte Abdichtung nicht erreicht, da der Druck, der durch das Zusammenwirken der Innenoberfläche der Kappe und der Oberkante des Behälters erzeugt wird, an diesen Stellen geringer ist, weil die Rinnen zu einer (hier gewünschten) Deformierung der Dichtungslippe führen. An den Stellen, an denen an der Innenoberfläche der Verschlußkappe keine Nuten vorhanden sind, ist der Druck größer, was zu einer ungleichmäßigen Abdichtung führt. Schließlich wird dadurch, daß die Nuten und somit die schwächeren Abdichtungsstellen radial angeordnet sind, eine zusätzliche Schwächung der Abdichtung des Behälters bewirkt, da die Nuten gewisserweise zu einer Überbrückung der Abdichtung führen.

Die Aufgabe der Erfindung besteht somit darin, eine Verbesserung der Abdichtung eines Behälters durch eine Verschlußkappe zu ermöglichen,

ohne die Herstellung einer solchen Verschlußkappe unnötig zu verkomplizieren oder zu verteuern.

Diese Aufgabe wird durch die in dem Patentanspruch 1 definierte Verschlußkappe gelöst.

Im einzelnen wird die Abdichtung gemäß der vorliegenden Erfindung dadurch erreicht, daß wenigstens eine Schulter vorgesehen wird, die das Dichtungsmittel gezielt gegen die Oberkante des Behälters drückt, wodurch eine Dichtungszone entsteht, in der das Dichtungsmittel mit hohem Druck gegen die Oberkante des Behälters gedrückt wird. Die Schulter gemäß dem Patentanspruch 1 ermöglicht eine gezielte Positionierung der Dichtungslippe auf dem Behälterrand unter einem hohen Auflagedruck. Dieser, zu einer sehr guten Abdichtung führende Verschlußvorgang wird ermöglicht, ohne die Verschlußkappe unnötig zu verkomplizieren.

Die Unteransprüche sind auf vorteilhafte Weiterbildungen der Erfindung gerichtet.

Patentanspruch 2 beschreibt ein Dichtungsmittel gemäß einer weiteren Ausführungsform, das in die Öffnung des Behälters eingreift. Auch dieses zweite Dichtungsmittel weist eine Schulter auf, die an der Innenseite des Behälters anliegt, wodurch eine zweite Dichtungszone erzeugt wird. Durch die Kombination dieser zwei Dichtungsmittel wird eine besonders hochwertige Abdichtung erreicht; darüber hinaus wird die Abdichtung des Behälters nicht wesentlich gefährdet, wenn ein Dichtungsmittel fehlerhaft sein sollte.

Der Anspruch 3 betrifft ein Ausführungsbeispiel, das für die Breite der Dichtungslippe bestimmte Abmessungen aufweist, die sich in umfangreichen Vergleichstests als besonders vorteilhaft erwiesen haben.

Der Anspruch 4 betrifft ein Ausführungsbeispiel, das eine für die Abdichtung besonders wirksame Position des Dichtungsmittels beansprucht.

Der Anspruch 5 betrifft ein Ausführungsbeispiel, das eine für die Abdichtung besonders wirksame Form des Kappenkörpers beansprucht.

Die Ansprüche 6 und 7 unterscheiden zwei Ausführungsbeispiele, gemäß denen entweder das Dichtungsmittel aus einem separaten Teil hergestellt oder integral mit dem Kappenkörper ausgebildet wird. Das Ausführungsbeispiel, in dem das Dichtungsmittel und der Kappenkörper aus einem Material bestehen (integrale Ausbildung), weist den Vorteil der einfachen und preiswerten Herstellung auf. In dem Ausführungsbeispiel, in dem das Dichtungsmittel und die Verschlußkappe aus separaten Teilen hergestellt werden, wird es möglich, die Verschlußkappe aus einem Material herzustellen, das preiswert und/oder wiederverwendbar ist, und das Dichtungsmittel aus einem Material, das besondere Dichtungseigenschaften aufweist.

Die Ansprüche 8 und 9 unterscheiden Ausführungsbeispiele, gemäß denen Die Dichtungslippe und/oder der Kappenkörper aus einem bestimmten Material hergestellt wird, das besondere Eigenschaften aufweist.

Die Ansprüche 10 und 11 charakterisieren Ausführungsbeispiele, die unterschiedliche Verschlußmechanismen aufweisen. Ein Schraubmechanismus findet heutzutage am häufigsten Anwendung, aber ein Bügelver-

schlußmechanismus wird in bestimmten Fällen bevorzugt, wie beispielsweise neuerdings wieder bei Bierflaschen.

Die Ansprüche 12 und 13 betreffen Ausführungsbeispiele, die unterschiedliche für die Abdichtung besonders wirksame Beschaffenheiten der Dichtungslippe beanspruchen.

Der Anspruch 14 betrifft ein Ausführungsbeispiel, das eine für die Abdichtung besonders wirksame Beschaffenheit des Kappenkörpers beansprucht.

Die Ansprüche 15 und 16 betreffen Ausführungsformen, die eine im Hinblick auf die Abdichtwirkung besonders vorteilhafte Formgebung der Dichtungslamelle betreffen.

Der Anspruch 17 betrifft eine Verschlußkappe, gemäß der die mit dem zu verschließenden Behälter zusammenwirkende Oberfläche des Dichtungsmittels eine schuppenartige bzw. strukturierte Oberfläche aufweist. Eine derartige Strukturierung weist den Vorteil auf, daß sie im Zusammenspiel mit auf der Oberseite des zu verschließenden Behälters vorhandenen Unebenheiten zu einem festen Sitz des Dichtungsmittels auf der Behälteroberkante führt.

Ein Ausführungsbeispiel der vorliegenden Erfindung wird im folgenden unter Bezugnahme auf die Zeichnung näher erläutert. Es zeigt:

Fig. 1 eine Schnittansicht durch eine Verschlußkappe im unverschlossenen Zustand, gemäß einer bevorzugten Ausführungsform;

Fig. 2 eine Schnittansicht durch einen zu verschließenden Behälter,

Fig. 3 eine Schnittansicht durch die Verschlußkappe im verschlossenen Zustand;

Fig. 4 eine Schnittansicht durch eine Verschlußkappe im unverschlossenen Zustand, gemäß einer weiteren bevorzugten Ausführungsform;

In Figur 1 ist eine Verschlußkappe zum lösbaren Verschließen einer Flasche gemäß einer derzeit bevorzugten Ausführungsform der vorliegenden Erfindung dargestellt. Die im Folgenden im einzelnen beschriebene Ausführungsform betrifft einen Schraubverschluß zum Verschließen einer Flasche, die kohlensäurehaltige Flüssigkeiten enthalten kann. Wie bereits zuvor erwähnt, wird jedoch darauf hingewiesen, daß die vorliegende Erfindung nicht auf Schraubverschlüsse für Flaschen beschränkt ist. Alternative Ausführungsformen betreffen beispielsweise Dosen, die sich für das Aufbewahren/Einfrieren von Nahrungsmitteln eignen, Einmachgläser, aber auch Verschlußkappen von Behältern, die nicht im Nahrungsmittelsektor eingesetzt werden, wie beispielsweise Farbeimer.

In Figur 1 ist eine Verschlußkappe in ihrer Ausgangsform in einer Schnittansicht dargestellt. Die Verschlußkappe besteht aus einem Kappenkörper 10, der ein oberes Deckenteil 18 und ein im wesentlichen zylindrisches Seitenteil 19 umfaßt. Das Seitenteil 19 erstreckt sich im wesentlichen senkrecht aus der Ebene des Deckenteils 18. Gemäß der in Figur 1 dargestellten Ausführungsform erfolgt der Übergang von dem Deckenteil 18 zu dem zylindrischen Seitenteil 19 nicht abrupt (scharfkantig), sondern mittels eines abgerundeten Übergangsteiles 20. Es wird darauf hingewiesen, daß in der gezeigten Ausführungsform das Deckenteil

18, das Seitenteil 19 und das Übergangsteil 20 keine separaten Elemente sind, sondern daß sie vielmehr zusammen den Kappenkörper 10 bilden.

An dem Seitenteil 19 ist ein Schraubgewinde 12 ausgebildet, das als Verschlußmechanismus dient, mittels dem die Verschlußkappe 10 auf dem zu verschließenden Behälter 100 befestigt wird. Das Schraubgewinde 12 wirkt mit einem entsprechenden, paarig ausgebildeten Schraubgewinde 112 (vergl. Fig. 2) auf der Flasche 100 zusammen. Es wird ausdrücklich darauf hingewiesen, daß das Schraubgewinde 12 nicht den einzigen möglichen Verschlußmechanismus für den zu verschließenden Behälter darstellt. Alle möglichen anderen Arten von an sich bekannten Verschlußmechanismen sind gleichfalls geeignet, wie etwa Bügelverschlüsse, in Aunsnehmungen eingreifende Nasen - bzw. Schultern, etc.

Wie man der Figur 1 entnehmen kann, wird gemäß der bevorzugten Ausführungsform der vorliegenden Erfindung an dem Seitenteil 20 innenliegend ein Dichtungsmittel 11 in Form einer radial umlaufenden Dichtungslippe 13 vorgesehen. Die Dichtungslippe 13 hat eine lange keilförmige Form. Im Ruhezustand (d.h. in dem Zustand, in dem die Verschlußkappe keinen Behälter verschließt) erstreckt sich die Dichtungslippe 13 vom Übergangsteil 20 her nahezu waagrecht, vorzugsweise jedoch mit einer geringen Neigung hin zum Mittelpunkt der Verschlußkappe. In einer besonders bevorzugten Ausführungsform beträgt die Neigung 41° bis 48° gegen die Horizontale, um die Entformung zu erleichtern (vergl. Fig. 4). Die Breite B der Dichtungslippe 13 wird vorzugsweise so gewählt, daß das innenliegende Ende der Dichtungslippe 13 im verschlossenen Zustand im wesentlichen bündig mit dem oberen Flaschenrand 104 abschließt (vgl. Figur 3). In einem besonders bevorzugtes Ausführungsbeispiel (vergl. Fig. 4) liegt die Breite B vorzugsweise im

Bereich zwischen 3,8 und 4,5 cm. Dadurch wird erreicht, daß die gesamte Oberkante 104 der Flasche 100 durch die kreisförmig im Kappenkörper 10 umlaufende Dichtungslippe 13 im wesentlichen vollständig beaufschlagt wird, wenn der Kappenkörper 10 auf die Flasche 12 aufgeschraubt ist. Die keilförmige, lange, dünne Dichtungslippe 13 paßt sich in ihrer Profilierung an unterschiedliche Flaschenhälse an, wenn während des Verschließvorgangs normale Drehmomente auf die Verschlußkappe ausgeübt werden. Insbesondere erfolgt eine Profilanpassung an der Oberkante 104 des Flaschenhalses sowohl oben außen als auch oben innen. Das Profil der Dichtungslippe 13 kann sich an jeden Krümmungsradius anpassen. Der Flaschenhals einer Mehrwegflasche ist mit 20,7 mm geringer als bei der Einwegflasche, deren Innendurchmesser 21,6 mm beträgt. In beiden Fällen legt sich die Dichtungslippe 13 auch nach innen in den Flaschenhals hinein. Im Endergebnis sitzt die erfindungsgemäße Verschlußkappe unter allen denkbaren Umgebungsbedingungen dicht auf der Flasche.

Die oben beschriebene Neigung des Dichtungslippe 13 in seiner Ruhelage ist an die Neigung der Oberfläche 104 der Flasche 100 aus der horizontalen Ebene heraus angepasst. wie man im einzelnen der Figur 2 entnehmen kann. Wie aus dieser Figur deutlich wird. weißt die Oberkante 104 der Flasche 100 eine (hier aus Veranschaulichungsgründen vergrößert dargestellte) Neigung aus der horizontalen Ebene H heraus auf, die mit S angedeutet ist. Es wird darauf hingewiesen, daß in Abhängigkeit des zu verschließenden Behälters unterschiedliche Ausgestaltungen der jeweiligen Oberfläche 104 gewählt werden können. Gemäß der erfingungsgemäßen Lehre wird vorzugsweise die Neigung bzw. Formgebung der Dichtungslippe 13 jeweils an die gewählte Oberflächenform des zu verschließenden Behälters angepaßt.

Von besonderer Bedeutung zur Erzielung des erfindungsgemäßen Erfolgs ist weiterhin die Dichtungslippe 13 mit einem bestimmten Dickenprofil vorzusehen, das mit dem Bezugszeichen D in Figur 1 angedeutet ist. Umfangreiche Vergleichstests, in denen das Abdichtverhalten der Verschlußkappe mit unterschiedlich dicken Dichtungslippen getestet worden ist, haben gezeigt, daß die Dichtungslippe 13 vorzugsweise an ihrer Wurzel 3/10 mm bis 7/10 mm stark ist und an ihrer Spitze eine Dicke von nicht mehr als 5/10 mm und nicht weniger als 2/10 mm haben sollte, und gemäß einer besonders bevorzugten Ausführungsform zwischen 2/10 mm und 4/10 mm. Diese Werte haben sich für zu verschließende GDB-Glasflaschen unter Verwendung der üblichen Plastikmaterialien für den Kappenkörper 10 als besonders vorteilhaft erwiesen. Für andere Verschlußkappen, die größere oder kleinere Behälter zu verschließen haben, ergeben sich entsprechend skalierte Werte.

Darüber hinaus weist die Dichtungslippe 13 eine spezielle schuppenartige Struktur auf, die mit den Unebenheiten auf der Oberkante 104 der Flasche 100 zusammenwirkt, um so ein besseres Abdichten der Flasche zu bewirken.

In den bislang diskutierten Ausgangsformen der vorliegenden Erfindung bestand der Kappenkörper 10 aus einem einzelnen Element, mit dem die Dichtungslippe 13 integral ausgebildet ist. Gemäß einer weiteren bevorzugten Ausführungsform der vorliegenden Erfindung ist es gleichfalls möglich, die Dichtungslippe 13 auf einem separaten, ringförmigen Element auszubilden und diesen je nach Bedarf in den Kappenkörper 10 einzusetzen. Die Fixierung dieses vorzugsweise flexiblen Ringes kann entweder durch Verklemmung oder Verklebung erfolgen. Vorzugsweise umfaßt der separat einzusetzende Ring gemäß dieser Ausführungsform nicht nur die Dichtungslippe, sondern darüber hinaus auch die unten

noch näher zu beschreibende Innenfläche 18' der Verschlußkappe und/-oder die elastische Lamelle 16. Eine derartige Ausführungsform hat den Vorteil, daß die erfindungsgemäßen Dichtungsmittel 11, 13, 16 auch als "Nachrüstsatz" in bestehende Schraubverschlüsse eingeführt werden können.

Die Dichtungsmittel 11 ist bei einer bevorzugten Ausführungsform so angeordnet, daß eine Kammer 33 zwischen dem Deckenteil 18 und dem Seitenteil 19 des Verschlußkörper und der dünnen, keilförmigen Dichtungslippe, also von der Dichtungslippe aus gesehen oben außen, entsteht. Diese Kammer 33 stellt einen Anpassungsspielraum für verschiedene Flaschenhalsdurchmesser bereit und unterstützt somit eine sichere Abdichtung des jeweiligen Behälters.

In Fig. 4 ist eine weitere besonders bevorzugte Ausführungsform der Verschlußkappe dargestellt, bei der das Dichtungsmittel 11 gemäß der erfindungsgemäßen Lehre an der Innenfläche 18' eine wellenförmige Struktur aufweist, wobei einzelne konzentrisch angeordnete, ringförmige Schultern 34a-f um das Deckenteil 18 herumlaufen. Ferner weist die Innenfläche 18' der Verschlußkappe eine Schräge von 0,5° bis 3° gegenüber der Horizontalen auf und ist wellenförmig gerippt, wie sich aus Fig. 4 ergibt. Diese Schultern 34 sind derartig angeordnet, daß die Dichtungslippe 13 im verschlossenen Zustand auf ihnen aufliegt und durch sie gegen die Oberkante 104 der Flasche 100 gepresst wird. Der Abstand zwischen den Schultern 34a-f ist vorzugsweise so gewählt, daß sie alle auf der Oberkante 104 der Flasche 100 aufliegen; in anderen Worten, wird der Radius R_S der konzentrisch umlaufenden Schultern vorzugsweise so gewählt, daß die äußerste Schulter 34a (Fig. 4) bzw. 14 (Fig. 1) sich benachbart zu der Aussenkante der Flasche 100 befindet, wohingegen sich die innerste Schulter 34f (Fig. 4) bzw. 15 (Fig. 1) benachbart zu der

Innenkante der Flasche 100 befindet. Gemäß einer besonders bevorzugten Ausführungsform liegt der Radius R_S der konzentrisch umlaufenden Schultern 34a-f im Bereich von 16,5 mm bis 18,5 mm, der Radius R_S der konzentrisch umlaufenden Schulter 15 bei 17,5 mm..

Wie man insbesondere der Figur 1 entnehmen kann. weisen die Schultern 14 und 15 unterschiedliche Höhen H_1, H_2 auf. Der Höhenunterschied H_2 - H_1 wird erfindungsgemäß so gewählt, daß sich unter Berücksichtigung des Gefälles S der Flaschenoberfläche 104 (vgl. Figur 2) ein gleichmäßiger Druck auf die Oberkante 104 der Flasche 100 im verschlossen Zustand einstellt. Wie man insbesondere der Figur 4 entnehmen kann, sind die Höhen der Schultern 34 bei dieser Ausführungsform erfindungsgemäß so gewählt, daß sich das Dichtungsmittel 11 im verschlossenen Zustand gleichsam an die Oberkante 104 der Flasche 100 anschmiegt und diese sicher abdichtet. Die Schultern 34a-f bei dieser Ausführungsform, wie auch die zwei Schulter 14 und 15 des Ausführungsbeispiels, das in Fig. 1 dargestellt ist, üben dabei einen gleichmäßigen Druck auf die Dichtungslippe 11 aus, der in Folge der geringen wirkenden Oberfläche der Schultern vergleichsweise hoch ist. In Zusammenspiel mit der an der unteren Seite der Dichtungslippe vorgesehenen Schuppenstruktur und den Unebenheiten auf der Oberkante 104 der Flasche 100 wird somit eine sichere und zuverlässige Abdichtung erreicht.

Gemäß einer weiteren bevorzugten Ausführungsform der vorliegenden Erfindung wird neben der Dichtungslippe 11 auch eine sich senkrecht vom Deckenteil 18 erstreckende, elastische Lamelle 16 vorgesehen, die sich im Ruhezustand senkrecht nach unten erstreckt (vergl. Fig. 1). Die Dichtungslamelle 16 läuft gleichfalls konzentrisch zur Mittellinie M des Kappenkörpers, wobei die Innenkannte einen Radius R_1 und die Aussenkannte einen Radius R_2 aufweist. Die Radien R_1 und R_2 sind

derart gewählt, daß die Dichtungslamelle 16 im Ruhezustand unmittelbar benachbart zur Dichtungslippe 11 verläuft, gemäß einer besonders bevorzugten Ausführungsform beträgt der Radius R_1 15,4 mm und Radius R_2 16,8 mm.

Gemäß der erfindungsgemäßen Lehre ist die Dichtungslamelle 16 mit einer Schulter 17 ausgestattet, deren höchster Punkt sich im Ruhezustand des Kappenkörpers 10 im Wesentlichen auf einer Zylinderoberfläche zusammen mit dem freien Ende der Dichtungslipppe 13 befindet. Der Radius der Schulter 17 beträgt vorzugsweise 0,25 mm und ist so gewählt, daß die Dichtungslamelle 16 vom höchsten Punkt der Schulter 17 zur Spitze der Lamelle 16 unter einem Winkel α läuft. Umfangreiche Vergleichstests haben gezeigt, daß der Winkel α vorzugsweise nicht mehr als 35° und nicht weniger als 25° haben sollte, und gemäß einer besonders bevorzugten Ausführungsform 28° haben sollte. Diese Werte haben sich für zu verschließende Glasflaschen unter Verwendung der üblichen Plastikmaterialien für den Kappenkörper 10 als besonders vorteilhaft erwiesen. Für andere Verschlußkappen, die größere oder kleinere Behälter zu verschließen haben, ergeben sich entsprechend skalierte Werte.

Wie man im einzelnen der Figur 3 entnehmen kann, wirkt die Schulter 17 der Dichtungslamelle 16 mit der Innenseite der Flasche 100 im verschlossenen Zustand zusammen, wobei durch Betätigung des Verschlußmechanismus 12 die Dichtungslamelle 16 aus ihrer Ruhelage abgelenkt und zum Flascheninneren hin verbogen wird. Genau wie bei den Schultern 14 bzw. 34a-f wird durch die kleine wirksame Oberfläche der Dichtungslamelle 16 (die im Wesentlichen durch den Kuppenbereich der Schulter 17 vorgegeben ist) ein vergleichsweise hoher Abdichtdruck

erreicht, der durch das Rückstellmoment der abgelenkten Dichtungslamelle 16 definiert wird.

Die erfindungsgemäße Verschlußklappe kann aus verschiedenen Materialien hergestellt werden. Wird das Dichtungsmittel 11 (zusammen mit den Schultern 14 bzw. 34a-f und der elastischen Lamelle 16) als integraler Bestandteil der Verschlußkappe vorgesehen, eignet sich insbesondere Polyethylen als Kappenmaterial. Wird das Dichtungsmittel 11 als separat herzustellendes Element vorgesehen, kann für den Kappenkörper 10 Weißblech verwendet werden, und für das auf einem Dichtungsring befestigte Dichtungsmittel 11 oder für den Kappenkörper 10 Polyethylen.

Zum Schluß der Beschreibung werden wichtige Aspekte der vorliegenden Erfindung in der Form der folgenden Klauseln A zusammengefaßt:

A1. Verschlußkappe zum lösbaren Verschließen eines Behälters, mit

a) einem Kappenkörper (10), der zu dem zu verschließenden Behälter (100) paarig ausgebildet ist;

b) einem Verschlußmechanismus (12), der den Behälter (100) mit dem Kappenkörper (10) lösbar verschließt;

c) einem Dichtungsmittel (11), das mit einer Oberkante (104) des Behälters (100) zusammenwirkt, um diesen beim Verschließen des Verschlußmechanismusses (12) abzudichten, dadurch gekennzeichnet, daß

d) wenigstens eine, am Kappenkörper (10) ausgebildete Schulter (14 oder 15) vorgesehen ist, die der Oberkante (104) des Behälters (100) gegenüberliegt und mit der das Dichtungsmittel (11) zusammenwirkt, wenn der Verschlußmechanismus (12) betätigt wird.

A2. Verschlußkappe nach Klausel 1, dadurch gekennzeichnet, daß desweiteren eine sich von der Innenseite des Kappenkörpers (10) im wesentlichen senkrecht in die Öffnung des Behälters (100) erstreckende elastische Lamelle (16) vorgesehen ist, die eine Lamellenschulter (17) aufweist, welche an der Innenseite des Behälters (100) anliegt, wenn der Verschlußmechanismus (12) betätigt wird.

A3. Verschlußkappe nach Klausel 1 oder 2, dadurch gekennzeichnet, daß das Dichtungsmittel (11) aus einer am Kappenkörper (10) befestigten Dichtungslippe (13) besteht, die benachbart zu der Oberkante des Behälters (100) verläuft und die eine Breite (B) aufweist, die im wesentlichen der Dicke (D) der Oberkante (104) des Behälters (100) entspricht.

A4. Verschlußkappe nach einem der vorigen Klauseln, dadurch gekennzeichnet, daß zwei Schultern (14, 15) vorgesehen sind, die zum Innern des Kappenkörpers (10) hin eine zunehmende Höhe (H_1, H_2) aufweisen, wobei der Höhenunterschied zwischen den zwei Schultern an die Form der Oberkante (104) des Behälters (100) angepaßt ist.

A5. Verschlußkappe nach einem der vorigen Klauseln, dadurch gekennzeichnet, daß der Kappenkörper (10) aus einem Deckenteil (18) und einem sich zu dem Deckenteil (18) senkrecht erstreckenden Seitenteil (19) besteht und das Dichtungsmittel innen an einem Übergangsteil (20) befestigt ist, das den Deckenteil (18) mit dem Seitenteil (19) verbindet.

A6. Verschlußkappe nach einem der Klauseln 1 bis 5, dadurch gekennzeichnet, daß das Dichtungsmittel (11) aus einem in den Kappenkörper (10) separat einzusetzenden Teil geformt ist.

A7. Verschlußkappe nach einem der Klauseln 1 bis 5, wobei das Dichtungsmittel (11) integral mit dem Kappenkörper (10) ausgebildet ist.

A8. Verschlußkappe nach einem der Klauseln 1 bis 7, dadurch gekennzeichnet, daß Polyethylen als Material für den Kappenkörper (10) Verwendung findet.

A9. Verschlußkappe nach einem der Klauseln 1 bis 7, dadurch gekennzeichnet, daß Weißblech als Material für den Kappenkörper (10) Verwendung findet.

A10. Verschlußkappe nach einem der vorigen Klauseln, dadurch gekennzeichnet, daß der Verschlußmechanismus (12) ein Schraubmechanismus ist.

A11. Verschlußkappe nach einem der Klauseln 1 bis 9, dadurch gekennzeichnet, daß der Verschlußmechanismus (12) ein Bügelverschlußmechanismus ist.

A12. Verschlußkappe nach einem der vorigen Klauseln, dadurch gekennzeichnet, daß die Dicke des Dichtungsmittels (11) an der Stelle, an der es mit einer Oberkante (104) des Behälters (100) zusammenwirkt, im Bereich zwischen 2/10 mm und 5/10 mm liegt.

A13. Verschlußkappe nach einem der vorigen Klauseln, dadurch gekennzeichnet, daß die Dicke (D) des Dichtungsmittels (11) an der Stelle, an der es mit einer Oberkante (104) des Behälters (100) zusammenwirkt, im Bereich zwischen 2/10 mm und 3/10 mm liegt.

A14. Verschlußkappe nach einem der vorigen Klauseln, dadurch gekennzeichnet, daß die Innenkante der Dichtungslamelle (16) mit der Aussenkante, die eine Verbindung zwischen der Spitze der Dichtungslamelle (16) und der Schulter (17) herstellt, einen Winkel α bildet, der im Bereich zwischen 25° und 35° liegt.

A15. Verschlußkappe nach einem der vorigen Klauseln, dadurch gekennzeichnet, daß die Innenkante der Dichtungslamelle (16) mit der Aussenkante, die eine Verbindung zwischen der Spitze der Dichtungslamelle (16) und der Schulter (17) herstellt, einen Winkel α bildet, der 28° beträgt.

A16. Verschlußkappe nach einem der vorigen Klauseln, dadurch gekennzeichnet. daß das Dichtungsmittel (11) auf seiner mit der Oberkante (104) des Behälters (100) zusammenwirkenden Oberfläche (15) mit einer schuppenartigen Struktur versehen ist.

Die Aspekte lassen sich auch anhand der folgenden Klauseln B charakterisieren:

B1. Verschlußkappe zum lösbaren Verschließen eines Behälters, mit

a) einem Kappenkörper (10), der zu dem zu verschließenden Behälter (100) paarig ausgebildet ist;

b) einem Verschlußmechanismus (12), der den Behälter (100) mit dem Kappenkörper (10) lösbar verschließt;

c) einem wenigstens zwei Schultern (14,15) umfassendes Dichtungsmittel (11), die mit einer Oberkante (104) des Behälters (100) zusammenwirkt, um diesen beim Verschließen des Verschlußmechanismusses (12) abzudichten und wobei eine weiter innen liegende Schulter (15) eine größere Höhe (H2) besitzt als eine weiter außenliegende Schulter (14, H1), dadurch gekennzeichnet, daß

d) das Dichtungsmittel (11) des weiteren eine geneigte Dichtungslippe (13) umfasst, die

- eine Breite (B) hat, die im wesentlichen der Dicke der Oberkante (104) des Behälters (100) entspricht,
- an der Stelle, an der sie mit der Oberkante (104) des Behälters (100) zusammenwirkt, eine Dicke (D) im Bereich zwischen 2/10 mm und 5/10 mm aufweist, und
- eine schuppenartige Struktur auf der Oberfläche aufweist, die mit der Oberkante (104) des Behälters (100) zusammenwirkt.

B2. Verschlußkappe nach Klausel 1, dadurch gekennzeichnet, daß desweiteren eine sich von der Innenseite des Kappenkörpers (10) im wesentlichen senkrecht in die Öffnung des Behälters (100) erstreckende elastische Lamelle (16) vorgesehen ist, die eine Lamellenschulter (17) aufweist, welche

an der Innenseite des Behälters (100) anliegt, wenn der Verschlußmechanismus (12) betätigt wird.

B3. Verschlußkappe nach einem der Klauseln 1 oder 2, dadurch gekennzeichnet, daß der Kappenkörper (10) aus einem Deckenteil (18) und einem sich zu dem Deckenteil (18) senkrecht erstreckenden Seitenteil (19) besteht und die Dichtungslippe (13) innen an einem Übergangsteil (20) befestigt ist, das den Deckenteil (18) mit dem Seitenteil (19) verbindet.

B4. Verschlußkappe nach einem der Klauseln 1 bis 3, dadurch gekennzeichnet, daß das Dichtungsmittel (11) aus einem in den Kappenkörper (10) separat einzusetzenden Teil geformt ist.

B5. Verschlußkappe nach einem der Klauseln 1 bis 3, wobei das Dichtungsmittel (11) integral mit dem Kappenkörper (10) ausgebildet ist.

B6. Verschlußkappe nach einem der Klauseln 1 bis 5, dadurch gekennzeichnet, daß Polyethylen als Material für den Kappenkörper (10) Verwendung findet.

B7. Verschlußkappe nach einem der Klauseln 1 bis 5, dadurch gekennzeichnet, daß Weißblech als Material für den Kappenkörper (10) Verwendung findet.

B8. Verschlußkappe nach einem der Klauseln 1 bis 7, dadurch gekennzeichnet, daß der Verschlußmechanismus (12) ein Schraubmechanismus ist.

B9. Verschlußkappe nach einem der Klauseln 1 bis 7, dadurch gekennzeichnet, daß der Verschlußmechanismus (12) ein Bügelverschlußmechanismus ist.

B10. Verschlußkappe nach einem der Klauseln 1 bis 9, dadurch gekennzeichnet, daß die Dicke (D) der Dichtungslippe (13) an der Stelle, an der es mit einer Oberkante (104) des Behälters (100) zusammenwirkt, im Bereich zwischen 2/10 mm und 3/10 mm liegt.

B11. Verschlußkappe nach einem der Klauseln 2 bis 10, dadurch gekennzeichnet, daß die Innenkante der Dichtungslamelle (16) mit der Aussenkante, die eine Verbindung zwischen der Spitze der Dichtungslamelle (16) und der Schulter (17) herstellt, einen Winkel α bildet, der im Bereich zwischen 25° und 35° liegt.

B12. Verschlußkappe nach einem der Klauseln 2 bis 11, dadurch gekennzeichnet, daß die Innenkante der Dichtungslamelle (16) mit der Aussenkante, die eine Verbindung zwischen der Spitze der Dichtungslamelle (16) und der Schulter (17) herstellt, einen Winkel α bildet, der 28° beträgt.

Die wesentlichen Aspekte der vorliegenden Erfindung können ferner noch durch die folgenden Klauseln C gekennzeichnet werden:

C1. Verschlußkappe zum lösbaren Verschließen eines Behälters, mit

a) einem Kappenkörper (10), der zu dem zu verschließenden Behälter (100) paarig ausgebildet ist;

b) einem Verschlußmechanismus (12), der den Behälter (100) mit dem Kappenkörper (10) lösbar verschließt;

c) einem Dichtungsmittel (11), das mit einer Oberkante (104) des Behälters (100) zusammenwirkt, um diesen beim Verschließen des Verschlußmechanismusses (12) abzudichten, dadurch gekennzeichnet , daß

d) das Dichtungsmittel (11) eine geneigten, keilförmigen Dichtungslippe (13) umfasst, die eine Breite (B) aufweist, die im wesentlichen größer als die Dicke der Oberkante (104) des Behälters (100) ist, und wobei die Innenfläche des Dichtungsmittels 11 an der Stelle, an der es mit der Dichtungslippe 13 zusammenwirkt, eine wellenförmig, gerippte Struktur aufweist.

C2. Verschlußkappe nach Klausel 1, dadurch gekennzeichnet, daß desweiteren eine sich von der Innenseite des Kappenkörpers (10) im wesentlichen senkrecht in die Öffnung des Behälters (100) erstreckende elastische Lamelle (16) vorgesehen ist, die eine Lamellenschulter (17) aufweist, welche an der Innenseite des Behälters (100) anliegt, wenn der Verschlußmechanismus (12) betätigt wird.

C3. Verschlußkappe nach Klausel 1 oder 2, dadurch gekennzeichnet, daß die Dichtungslippe (13) eine Breite (B) aufweist, die im wesentlichen der Dicke (D) der Oberkante (104) des Behälters (100) entspricht.

C4. Verschlußkappe nach einem der Klauseln 1 bis 3, dadurch gekennzeichnet, daß der Kappenkörper (10) aus einem Deckenteil (18) und einem sich zu dem Deckenteil (18) senkrecht erstreckenden Seitenteil (19) besteht und das Dichtungsmittel (11) innen an einem Übergangsteil (20) befestigt ist, das den Deckenteil (18) mit dem Seitenteil (19) verbindet.

C5. Verschlußkappe nach einem der Klauseln 1 bis 4, dadurch gekennzeichnet, daß der Deckenteil (18) eine Schräge von 0,5° bis 3° aufweist.

C6. Verschlußkappe nach einem der Klauseln 1 bis 5, dadurch gekennzeichnet, daß das Dichtungsmittel (11) aus einem in den Kappenkörper (10) separat einzusetzenden Teil geformt ist.

C7. Verschlußkappe nach einem der Klauseln 1 bis 5, wobei das Dichtungsmittel (11) integral mit dem Kappenkörper (10) ausge0bildet ist.

C8. Verschlußkappe nach einem der Klauseln 1 bis 7, dadurch gekennzeichnet, daß Polyethylen als Material für den Kappenkörper (10) Verwendung findet.

C9. Verschlußkappe nach einem der Klauseln 1 bis 7, dadurch gekennzeichnet, daß Weißblech als Material für den Kappenkörper (10) Verwendung findet.

C10. Verschlußkappe nach inem der Klauseln 1 bis 9, dadurch gekennzeichnet, daß der Verschlußmechanismus (12) ein Schraubmechanismus ist.

C11. Verschlußkappe nach einem der Klauseln 1 bis 9, dadurch gekennzeichnet, daß der Verschlußmechanismus (12) ein Bügelverschlußmechanismus ist.

C12. Verschlußkappe nach einem der Klauseln 1 bis 11, dadurch gekennzeichnet, daß die Dicke (D) der Dichtungslippe (13) an der Spitze im Bereich zwischen 2/10 mm und 4/10 mm liegt und an ihrer Wurzel im Bereich zwischen 3/10 mm und 7/10 mm liegt.

C13. Verschlußkappe nach einem der Klauseln 1 bis 12, dadurch gekennzeichnet, daß die Dichtungslippe 13 um 41° bis 48° gegen die Horizontale geneigt ist.

C14. Verschlußkappe nach einem der Klauseln 1 bis 13, dadurch gekennzeichnet, daß eine Kammer 33 zwischen dem Dekkenteil 18 und dem Seitenteil 19 des Verschlußkörper und der dünnen, keilförmigen Dichtungslippe angeordnet ist, um einen Anpassungsspielraum bereitzustellen.

C15. Verschlußkappe nach einem der Klauseln 1 bis 14, dadurch gekennzeichnet, daß die Innenkante der Dichtungslamelle (16) mit der Aussenkante, die eine Verbindung zwischen der Spitze der Dichtungslamelle (16) und der Schulter (17) herstellt, einen Winkel α bildet, der im Bereich zwischen 25° und 35° liegt.

C16. Verschlußkappe nach einem der Klauseln 1 bis 15, dadurch gekennzeichnet, daß die Innenkante der Dichtungslamelle (16) mit der Aussenkante, die eine Verbindung zwischen der Spitze der Dichtungslamelle (16) und der Schulter (17) herstellt, einen Winkel α bildet, der 28° beträgt.

C17. Verschlußkappe nach einem der vorigen Klauseln, dadurch gekennzeichnet, daß das Dichtungsmittel (11) auf seiner mit der Oberkante (104) des Behälters (100) zusammenwirkenden Oberfläche (15) mit einer schuppenartigen Struktur versehen ist.

Patentansprüche

1. Verschlußkappe zum lösbaren Verschließen eines Behälters, mit

a) einem Kappenkörper (10), der zu dem zu verschließenden Behälter (100) paarig ausgebildet ist;

b) einem Verschlußmechanismus (12), der den Behälter (100) mit dem Kappenkörper (10) lösbar verschließt;

c) einem Dichtungsmittel (11), das mit einer Oberkante (104) des Behälters (100) zusammenwirkt, um diesen beim Verschließen des Verschlußmechanismusses (12) abzudichten, d a d u r c h g e k e n n z e i c h n e t , d a ß

d) das Dichtungsmittel (11) eine geneigten, keilförmigen Dichtungslippe (13) umfasst, die eine Breite (B) aufweist, die im wesentlichen größer als die Dicke der Oberkante (104) des Behälters (100) ist, und wobei die Innenfläche des Dichtungsmittels 11 an der Stelle, an der es mit der Dichtungslippe 13 zusammenwirkt, eine wellenförmig, gerippte Struktur aufweist.

2. Verschlußkappe nach Anspruch 1, dadurch gekennzeichnet, daß desweiteren eine sich von der Innenseite des Kappenkörpers (10) im wesentlichen senkrecht in die Öffnung des Behälters (100) erstreckende elastische Lamelle (16) vorgesehen ist, die eine Lamellenschulter (17) aufweist, welche an der Innenseite

des Behälters (100) anliegt, wenn der Verschlußmechanismus (12) betätigt wird.

3. Verschlußkappe nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Dichtungslippe (13) eine Breite (B) aufweist, die im wesentlichen der Dicke (D) der Oberkante (104) des Behälters (100) entspricht.

4. Verschlußkappe nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß der Kappenkörper (10) aus einem Deckenteil (18) und einem sich zu dem Deckenteil (18) senkrecht erstreckenden Seitenteil (19) besteht und das Dichtungsmittel (11) innen an einem Übergangsteil (20) befestigt ist, das den Deckenteil (18) mit dem Seitenteil (19) verbindet.

5. Verschlußkappe nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß der Deckenteil (18) eine Schräge von 0,5° bis 3° aufweist.

6. Verschlußkappe nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß das Dichtungsmittel (11) aus einem in den Kappenkörper (10) separat einzusetzenden Teil geformt ist.

7. Verschlußkappe nach einem der Ansprüche 1 bis 5, wobei das Dichtungsmittel (11) integral mit dem Kappenkörper (10) ausgebildet ist.

8. Verschlußkappe nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß Polyethylen als Material für den Kappenkörper (10) Verwendung findet.

9. Verschlußkappe nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß Weißblech als Material für den Kappenkörper (10) Verwendung findet.

10. Verschlußkappe nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß der Verschlußmechanismus (12) ein Schraubmechanismus ist.

11. Verschlußkappe nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß der Verschlußmechanismus (12) ein Bügelverschlußmechanismus ist.

12. Verschlußkappe nach einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, daß die Dicke (D) der Dichtungslippe (13) an der Spitze im Bereich zwischen 2/10 mm und 4/10 mm liegt und an ihrer Wurzel im Bereich zwischen 3/10 mm und 7/10 mm liegt.

13. Verschlußkappe nach einem der Ansprüche 1 bis 12, dadurch gekennzeichnet, daß die Dichtungslippe 13 um 41° bis 48° gegen die Horizontale geneigt ist.

14. Verschlußkappe nach einem der Ansprüche 1 bis 13, dadurch gekennzeichnet, daß eine Kammer 33 zwischen dem Deckenteil 18 und dem Seitenteil 19 des Verschlußkörper und der dünnen, keilförmigen Dichtungslippe angeordnet ist, um einen Anpassungsspielraum bereitzustellen.

15. Verschlußkappe nach einem der Ansprüche 1 bis 14, dadurch gekennzeichnet, daß die Innenkante der Dichtungslamelle (16)

mit der Aussenkante, die eine Verbindung zwischen der Spitze der Dichtungslamelle (16) und der Schulter (17) herstellt, einen Winkel α bildet, der im Bereich zwischen 25° und 35° liegt.

16. Verschlußkappe nach einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß die Innenkante der Dichtungslamelle (16) mit der Aussenkante, die eine Verbindung zwischen der Spitze der Dichtungslamelle (16) und der Schulter (17) herstellt, einen Winkel α bildet, der 28° beträgt.

17. Verschlußkappe nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß das Dichtungsmittel (11) auf seiner mit der Oberkante (104) des Behälters (100) zusammenwirkenden Oberfläche (15) mit einer schuppenartigen Struktur versehen ist.

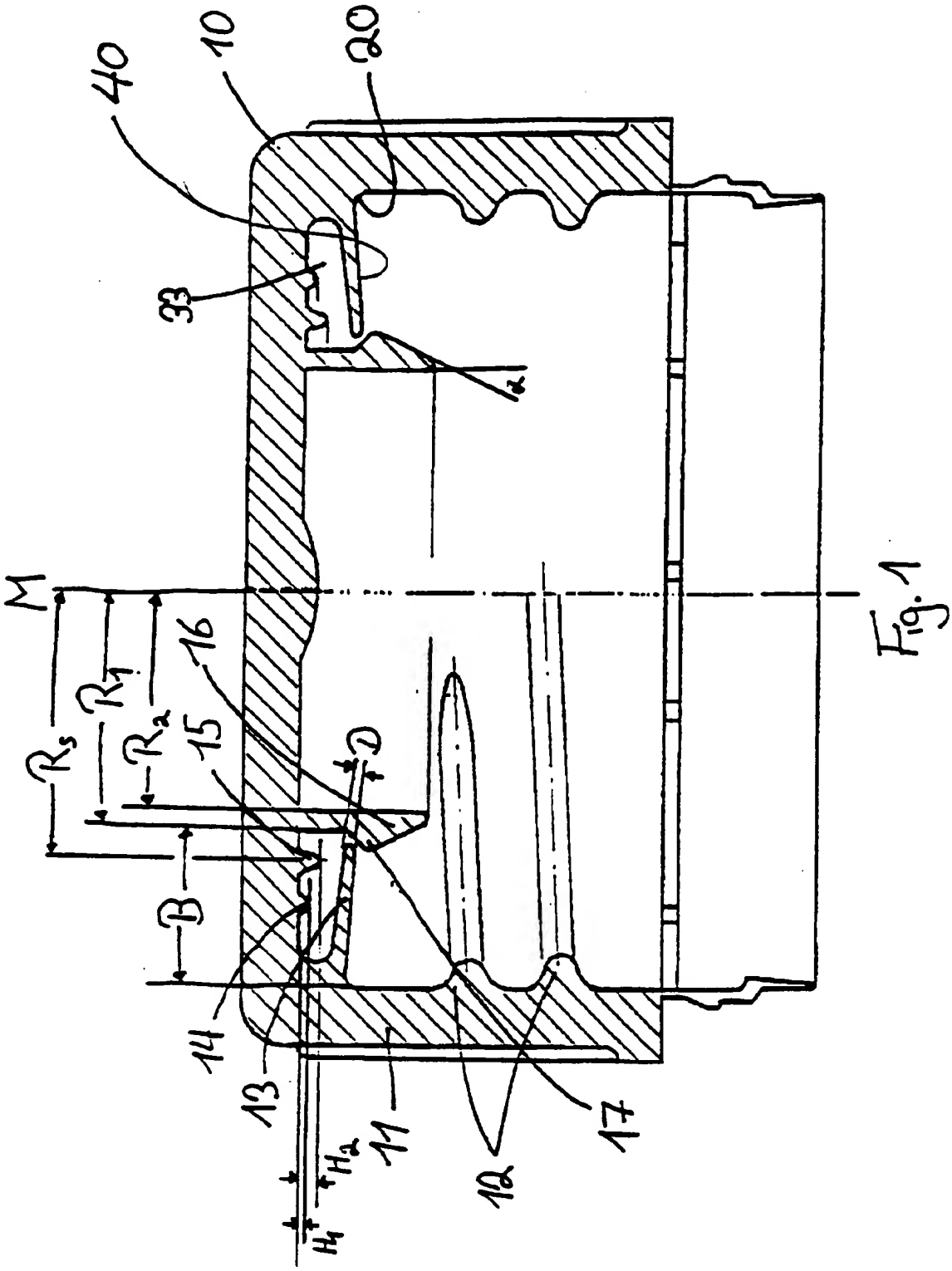

Fig. 1

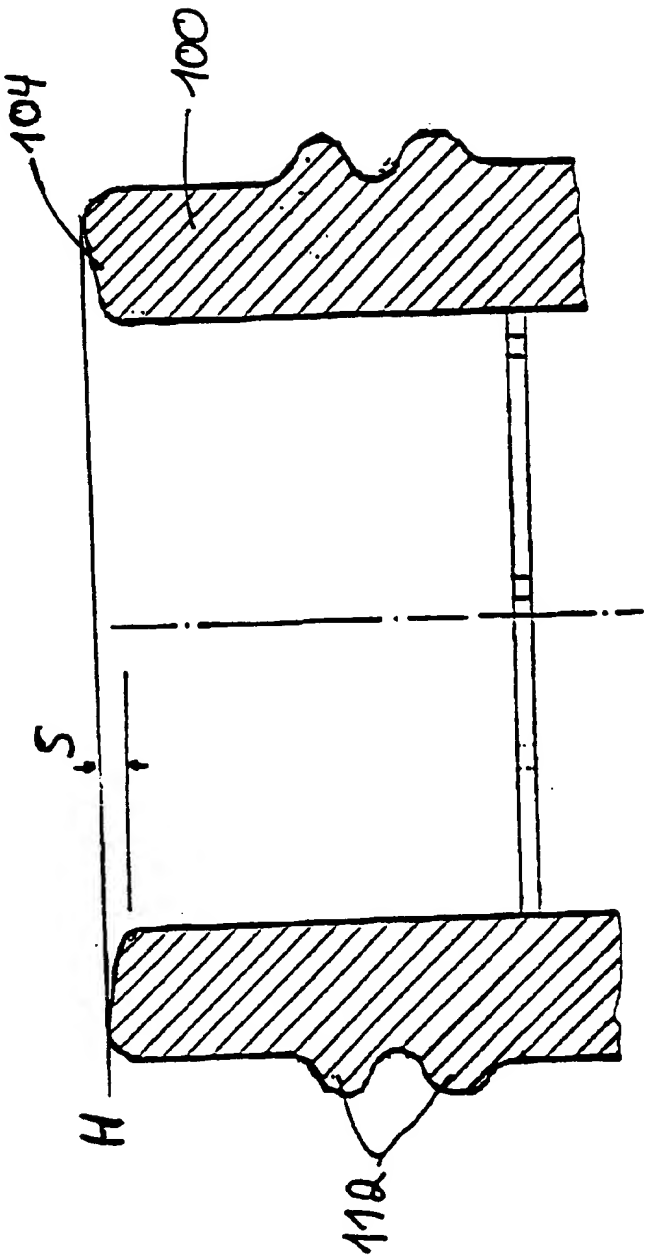

Fig. 2

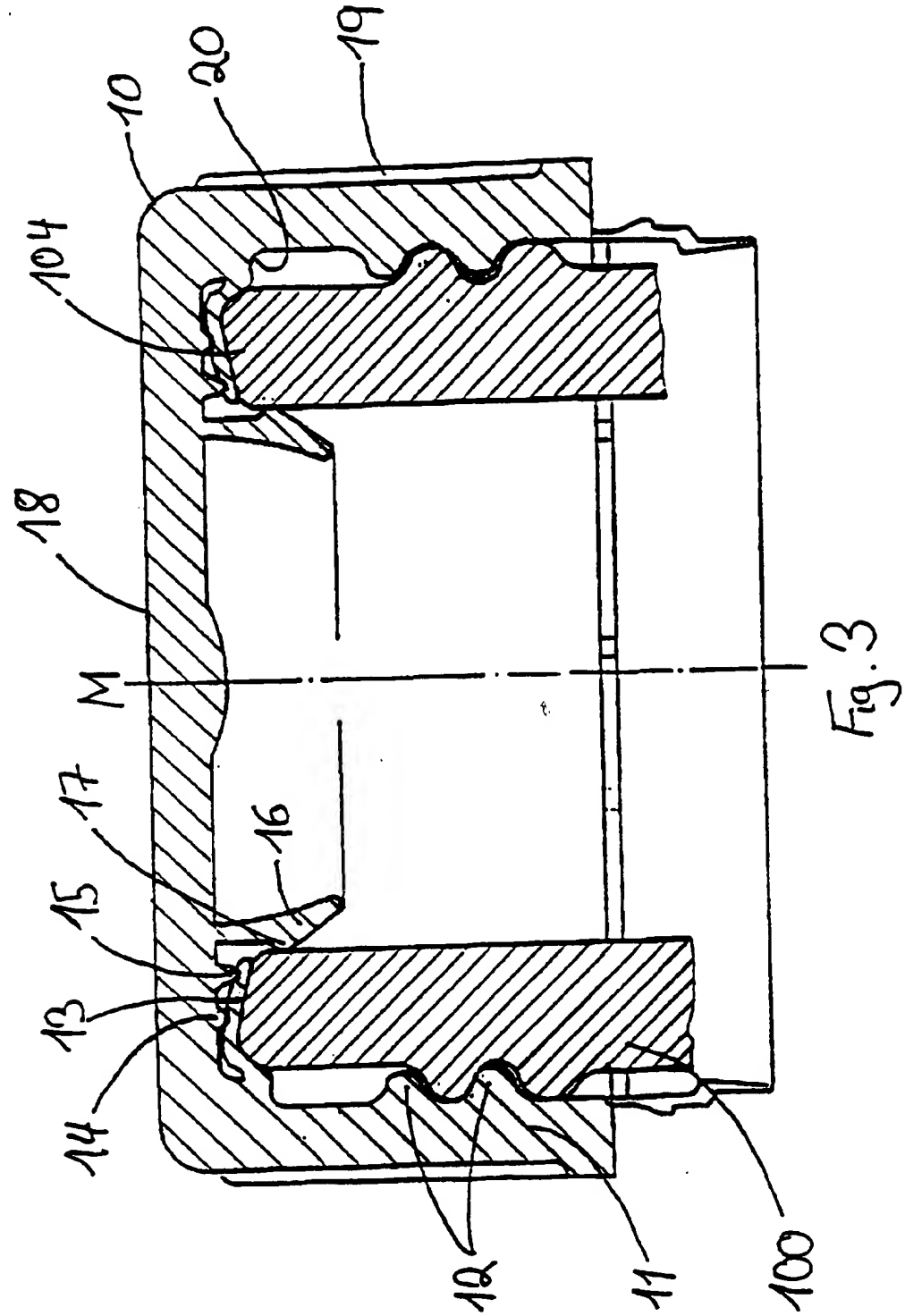

Fig. 3

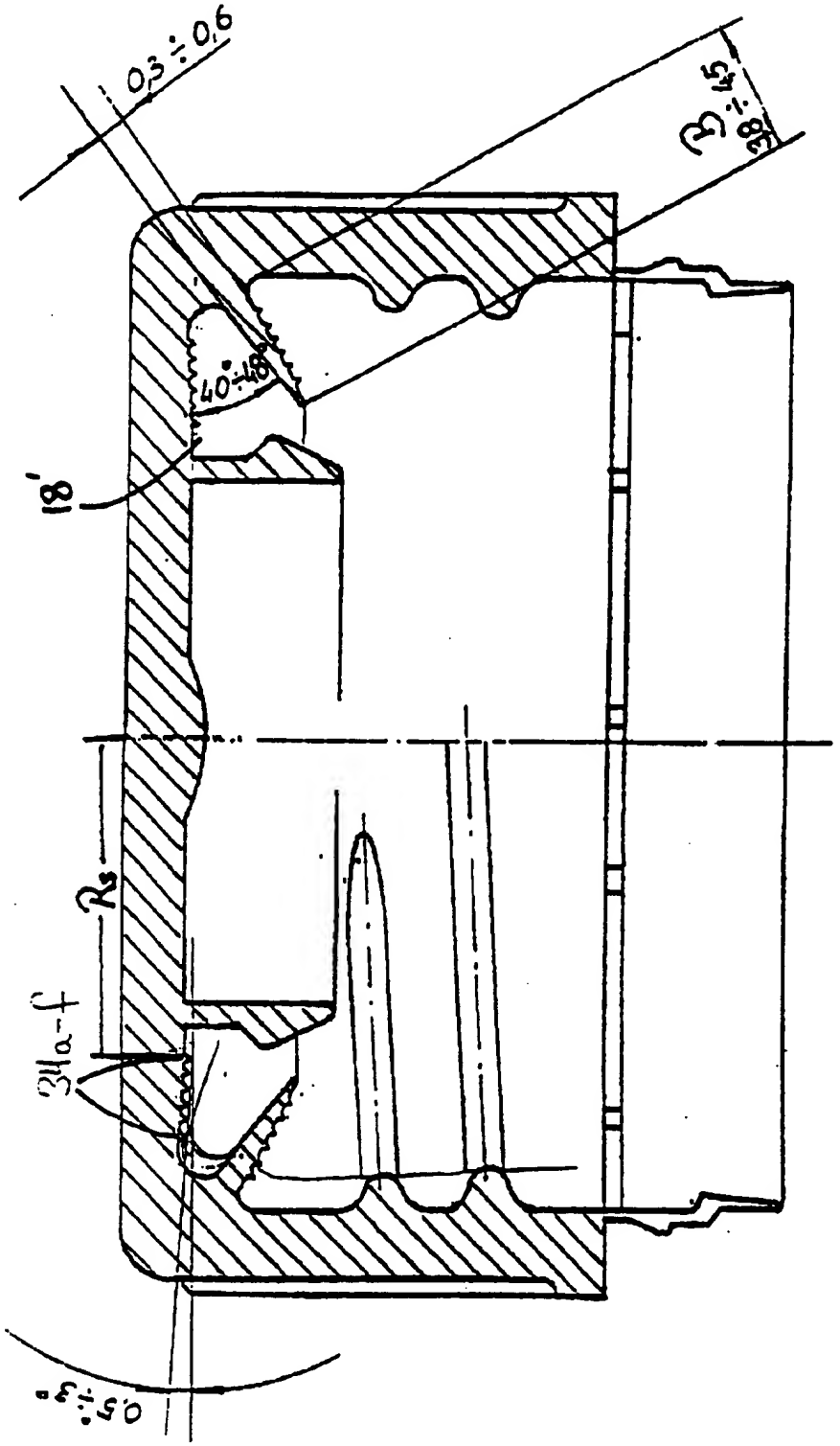

Fig. 4

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/EP 95/01816

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65D41/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US,A,4 450 973 (TOEPPEN) 29 May 1984 see the whole document ---	1,3,4,7, 8,10,13, 14,17 2,6,9
Y	US,A,4 392 055 (WHITNEY) 5 July 1983 see figure 1 ---	2
Y	US,A,4 896 782 (HAWKINS ET AL) 30 January 1990 see column 3, line 67 - column 4, line 11; figure 1 ---	6
Y	US,A,3 516 565 (HATKEVICH) 23 June 1970 see column 1, line 19 - line 21 --- -/--	9

[X] Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
12 September 1995	22. 09. 95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Smith, C

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INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/EP 95/01816

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 109 631 (WIEDMER) 30 May 1984 see the whole document ---	1,3,4,7, 10,14,17
X	FR,A,2 420 505 (METAL CLOSURES GROUP LIMITED) 19 October 1979 see figures -----	1

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INTERNATIONAL SEARCH REPORT

...information on patent family members

Inter... nal Application No
PCT/EP 95/01816

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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US-A-4392055	05-07-83	CA-A-	1177443	06-11-84
US-A-4896782	30-01-90	CA-A-	2008707	13-08-90
		DE-A-	4002982	16-08-90
		FR-A-	2643047	17-08-90
		GB-A-	2227995	15-08-90
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		AT-B-	364264	12-10-81
		AU-B-	522341	27-05-82
		AU-A-	4163778	27-09-79
		BE-A-	872374	16-03-79
		CA-A-	1098876	07-04-81
		CH-A-	629458	30-04-82
		DE-A-	2836060	27-09-79
		NL-A-	7811509	25-09-79
		SE-A-	7811792	23-09-79
		US-A-	4249362	10-02-81

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INTERNATIONALER RECHERCHENBERICHT

Internales Aktenzeichen
PCT/EP 95/01816

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 6 B65D41/04

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C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	US,A,4 450 973 (TOEPPEN) 29.Mai 1984	1,3,4,7, 8,10,13, 14,17
Y	siehe das ganze Dokument	2,6,9
Y	US,A,4 392 055 (WHITNEY) 5.Juli 1983 siehe Abbildung 1	2
Y	US,A,4 896 782 (HAWKINS ET AL) 30.Januar 1990 siehe Spalte 3, Zeile 67 - Spalte 4, Zeile 11; Abbildung 1	6
Y	US,A,3 516 565 (HATKEVICH) 23.Juni 1970 siehe Spalte 1, Zeile 19 - Zeile 21	9

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12.September 1995	22.09.95

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Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Smith, C

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INTERNATIONALER RECHERCHENBERICHT

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C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	EP,A,0 109 631 (WIEDMER) 30.Mai 1984 siehe das ganze Dokument ---	1,3,4,7, 10,14,17
X	FR,A,2 420 505 (METAL CLOSURES GROUP LIMITED) 19.Oktober 1979 siehe Abbildungen -----	1

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Internationales Aktenzeichen
PCT/EP 95/01816

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
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		DE-A-	4002982	16-08-90
		FR-A-	2643047	17-08-90
		GB-A-	2227995	15-08-90
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9516347.3	9 August 1995 (09.08.95)	GB

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(74) Agents: STEBBING, Peter, John, Hunter et al.; Ablett & Stebbing, 45 Lancaster Mews, Lancaster Gate, London W2 3QQ (GB).

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Published

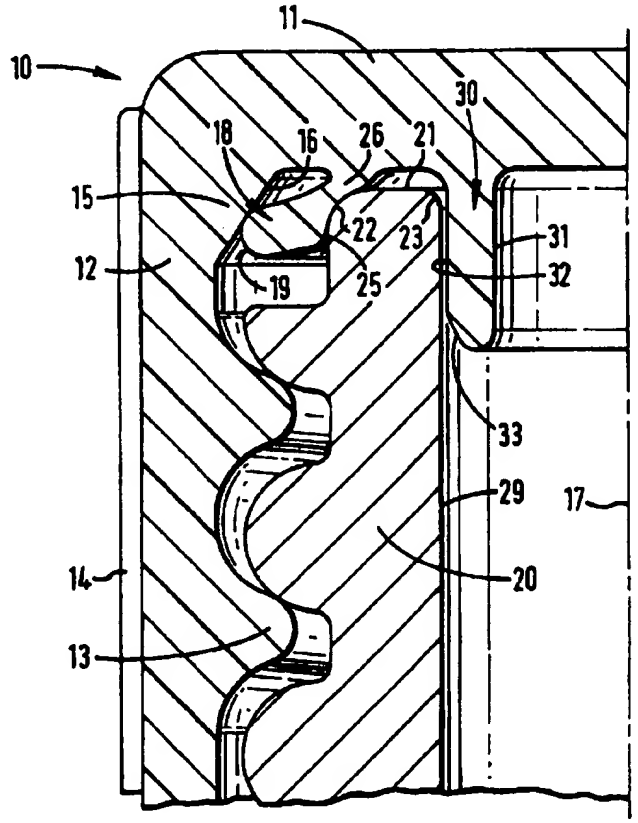
With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: SELF-CENTERING CONTAINER CLOSURE

(57) Abstract

The invention provides a container closure moulded in one piece from a plastics material and comprising a crown (11), a dependent skirt (12), the radially inner surface of which is formed with a screw thread (13), a surface (16) which is flared in a direction away from the top being formed on the internal surface of the skirt where it joins the crown and an annular resilient fin (18) extending downwardly and outwardly from an articulation position (26) on the underside of the top at position spaced radially inward of said flared surface having a length such as to permit at least its portion adjoining its free edge to lie against the flared surface (16), wherein the fin is deformed outwardly by the top of the neck of the container to which the closure is to be applied, characterised by a continuous or discontinuous locator annulus (30) depending downwardly from the undersurface of the crown (11) and disposed radially inwardly of the fin (18), the locator annulus extending downwardly by a distance greater than the fin (18) and having an outer diameter just smaller than that of the inner diameter of the container neck (20) with which it is to be used. Closures of this type allow effective reliable capping.



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SELF-CENTERING CONTAINER CLOSURE

The present invention relates to a self-centering container closure particularly of the type adapted for utilisation with a gaseous liquid.

Container closures moulded in one piece from a plastics material are well known in the art. One such is disclosed in our earlier European Patent No. 0136088 which relates to a container closure moulded in one piece from a plastics material and comprising a top (or crown), a dependent skirt the radially inner surface of which is formed with screw thread, a surface which is flared in a direction away from the top being formed on the internal surface of the skirt where it joins the top, and an annular resilient flexible fin extending downwardly and outwardly from the underside of the top at a position spaced regularly inwardly in said flared surface and having a length such as to permit at least its portion adjoining its free edge to lie against said flared surface when the fin is deformed outwardly by the rim of the neck of a container to which the closure is to be applied.

Whereas closures of this type work satisfactorily but there remains the problem of centralising the cap on the container in a really reliable way and of preventing "cocking" which is occasioned during capping. During capping it is difficult to ensure that the plane of the crown becomes perpendicular to the axis of the container neck prior to rotation. This is not always possible during high speed capping and accordingly a problem arises when the caps are screwed rapidly onto the container necks. Whereas a certain tolerance in the screw-thread portions can allow a degree of "cocking" to be corrected during capping, it is relatively easy to destroy the closures during the capping procedure due to this defect.

Container closures including downwardly depending internal bore seals are also known in the art. The purpose of these arrangements is to enable a cap to be rapidly screwed onto a container neck such that the rim of a container neck seals against the underside of the crown, whereas the internal bore of the container neck is in sealing contact with the bore seal annulus.

In a full bottle of a carbonated beverage as the temperature rises, gas tends to come out of solution and to increase the gas pressure in the container. This tends to force the underside of the crown of container closure upwardly thereby overcoming the lateral pressure exerted on the inner face of the prior art bore seals and thereby allows a fluid path to open up between the outer face of the bore seal and the inner face of the container neck towards the rim. Simultaneously a doming effect impairs the seal between the underside of the crown and the rim of the container neck. Accordingly gaseous escape paths are generated and gas escapes from the container. The consumer can therefore be left with a "flat" contents. This effect is accentuated if scratches are present on the rim of the container neck because these also tend to allow gas to escape. This is an especial problem with recycled containers.

The present invention has as its object the alleviation of these problems by providing closures of the foregoing general type provided with means for self-centering during capping and means for alleviating the problem of cocking.

In a further aspect of the present invention, the invention also provides means for reducing the incidence of doming. The arrangement of the invention can also reduce the possibility of successful tampering because the closure is retained substantially coaxial in the container neck.

The invention is characterised by a continuous or discontinuous locat r annulus depending downwardly from the

under surface of the crown and disposed radially inwardly of the fin annulus, the locator annulus extending downwardly by a distance greater than that of the fin and having an outer diameter just smaller than the inner diameter of the container neck with which it is to be used. The distance may be up to 100% longer than the corresponding distance from the underside of the crown to the fin.

The fin may be bulbous at its remote end and may be provided with a neck contact surface inclined inwardly and upwardly towards the crown for contact in use with the outer rim of the container neck. Preferably the central point of an articulation portion of the fin is located along a line parallel to the axis of the closure and within the outer one half of the diameter of the container neck with which the closure is to be used. In a preferred embodiment, the central point of the articulation portion is within the outer one third or even one quarter of the diameter of the container neck.

The articulation portion may have a radial thickness greater than one quarter of the radial thickness of the bulbous fin. This means that when the closure has been centered on the neck by operation of the locator annulas, the inclined surface of the bulbous fin contacts the outer rim of the container neck and, since the closure is rotating and since the bulbous fin is a relatively strong annulus, the inclined surface thereof tends to further ensure centering of the closure prior to and during deformation. By this means, "cocking" is alleviated since contact under rotation tends to locate the closure in its correct orientation perpendicular to the axis of the closure.

The angle of the inclined plane of the bulbous fin is preferably between about 35° and 55° and most preferably about 45° relative to the axis of the container closure.

The remote end of the locator annulus may be chamfered or th radially outer remote end thereof may be inwardly and downwardly inclined so as to present an outwardly and upwardly inclined surface to the inner rim of the container neck. Preferably the upper end of the inclined plane of the locator annulus terminates at or adjacent a notional plane horizontal to the axis of the closure which is also generally coincident with the lower end of the inclined contact surface of the bulbous fin. Thus, the two mutually opposed inclined planes respectively of the bulbous fin and the locator annulus operate sequentially upon a container rim. The angle of the inclined plane of the locator annulus is preferably 25° to 35° relative to the axis of the container closure.

It will also be appreciated that the positioning of the locator annulus radially inwardly of the fin has the effect of strengthening the crown against "doming". Thus a combination of the fin (preferably bulbous) and the locator annulus is particularly effective in resisting doming and its effects on the seal achievable by the fin outboard thereof. The closures of this type are most preferably made by injection moulding.

The invention will now be described, by way of illustration only with reference to the accompanying drawings which show in Figures 1 and 2 fragmentary elevations illustrating the closures in accordance with the present invention prior to, and on application.

The closure 10 is moulded in one piece from a resilient plastics material and has a top (crown) 11 and a dependent skirt 12 formed with an internal screw thread 13 and external knurling 14. A corner region 15 at the upper end of the skirt is thickened and has a conically flared internal surface 16 extending at an angle of about 30° from the axis of the closure 10. Spaced radially inwardly of the surface 16 is a resilient bulbous fin 18 which extends from an articulation

point 26 on the under side of the top 11. The bulbous fin 18 thus depends downwardly from the articulation point 26. The radially inner surface 27 extends generally parallel to the plane of the skirt 12 whereas the radially outer portion 28 of the bulbous fin is curved generally radially outwardly and downwardly to define at its remote end an outer sealing portion 19. The outer sealing portion is conjoined to the inner radially inner surface 27 by means of an inclined plane 25 having an angle of about 45°.

Closures of this type may be produced, preferably by injection moulding, with or without a tamper evident band. Preferably the skirt terminates in a plurality of frangible bridges 34 supporting a tamper evident band 35 for cooperation with a plain security band 36 on the outer neck portion of a container neck 20 in the usual way.

In use, the container closure 10 is applied to a neck 20 of a container so that the rim 21 of the container neck moves upwardly as in Figure 1 to adopt the position shown in Figure 2. As it does so, the inclined plane 25 of the bulbous fin 18 comes into contact with the outer rim portion 22 of the container neck 20 while the closure 10 is being rotated during the capping operation. This has the subsequent effect of assisting in a centering action such that the axis of the container closure and the container neck become coaxial with more certainty. Further rotation of the container closure 10 relative to the container neck 20 causes the container neck to move upwardly relative to the container closure to adopt the position shown in Figure 2. It will be noted in that the articulation of point 26 is disposed approximately one third of the radial distance between the inner and outer surface of the container neck such that the bulbous fin 18 is deformed radially outwardly to seal between the inclined surface 25 and conically flared internal surface 16. At the same time, because of this radial displacement, there is a piv tal f rce applied to the internal surface of the crown closur which

tends to resist doming in conjunction with th l cator annulus 30 referred to below.

Arrangements of the foregoing type are used with the main feature of the invention shown in Figures 1 and 2, i.e. the locator annulus 30. Disposed radially inwardly of the bulbous fin 18, the locator annulus 30 has a external diameter 32 which is just smaller than the inner diameter of the internal surface 29 of the container neck. The locator annulus 30 is provided therefore with a radially inner face 31, a radially outer face 32, said radially outer face 32 culminating towards its remote end in an annular inclined plane 33 which extends upwardly and outwardly towards the inner face of the container neck 29.

In use during the capping procedure, the inner rim portion 23 which is radiused comes into contact with the inclined plane of the locator annulus 33 which has the effect of centering the container closure on the container neck. As the cap is rotated, there is relative movement between the container neck 20 and the closure 10 such that it adopts the position shown in Figure 2. Because the locator annulus is not intended as a seal but essentially and primarily as a locator means, the sealing effect is to be found between the outer rim portion 22 and the bulbous fin 18. The effect of this is that because the closure 10 is correctly orientated relative to the container neck 20 the problems of "cocking" and centering are correctly addressed.

Further and probably as importantly, because the locator annulus is disposed in-board of the bulbous fin, it tends to strengthen the central portions of the crown 11. This resists doming.

The locator annulus 30 has the further effect of r taining the closure coaxially upon the container neck thus resisting tamp ring.

It will thus be seen that during application of the closure 10 to the container neck 20, the rim of the container 21 first comes into contact with the inclined surface 33 of the locator annulus 30 prior to any contact of the bulbous fin 18. This tends to center and directly orientate the closure relative to the container neck. Subsequently the outer rim portion 22 of the container neck 20 comes into contact with the inclined plane 25 which has a further centering and anti-cocking action as a primary factor with the secondary effect of causing the bulbous fin 18 to articulate at the point 26 as such that the surface 28 comes into contact with the conically flared internal surface 16 thereby causing effective sealing.

It will also be appreciated that by virtue of the relative thickness of the bulbous fin 18 taken with the effects of the locator annulus, a more effective seal is provided than previously. The locator annulus also tends to absorb all lateral forces of application generated by the combination of the application of force and the helical angle of the container/closure threads. This ensures that none of these forces impinge upon the bulbous fin 18 such that the same is inconsistently engaged with the container.

The locator annulus and the stiffness of the closure crown together have the effect that any doming of the crown under pressure will only take place within the circumference of the locator annulus 30. This has two effects. In the first place it reduces the effects of doming upon the bulbous fin 18 thus ensuring that the fin does not get pulled out of sealing engagement with the container during cases of extreme doming. Further the locator ring acts as a stiffening rib which resists and reduces the degree of doming exerted by the internal force, This tends to reduce storage problems when the containers are stacked.

This invention is particularly desirable when applying a closure to returnable containers where there is a risk of

possible damag t the outside corner/surface of the container which might provide a leakage path past the bulbous fin seal in high temperature storage conditions where doming can be expected.

The inventive closures are preferably made by injection moulding of high density polyethylene plastics materials. The locator annulus is intended to have no sealing properties and hence needs to be used in conjunction with a primary seal for example as hereinbefore set forth.

The invention provides therefore a closure as hereinbefore set forth and an assembly thereof with container closure.

CLAIMS:

1. A container closure moulded in one piece from a plastics material and comprising a crown 11, a dependent skirt 12, the radially inner surface of which is formed with a screw thread 13, a surface 16 which is flared in a direction away from the top being formed on the internal surface of the skirt where it joins the crown and an annular resilient fin 18 extending downwardly and outwardly from an articulation position 26 on the underside of the top at position spaced radially inward of said flared surface having a length such as to permit at least its portion adjoining its free edge to lie against the flared surface 16, wherein the fin is deformed outwardly by the top of the neck of the container to which the closure is to be applied,
characterised by a continuous or discontinuous locator annulus 30 depending downwardly from the undersurface of the crown 11 and disposed radially inwardly of the fin 18, the locator annulus extending downwardly by a distance greater than the fin 18 and having an outer diameter just smaller than that of the inner diameter of the container neck 20 with which it is to be used.

2. A container closure as claimed in claim 1 characterised in that the fin 18 is bulbous at its remote end and is provided with a rim contact surface 25 inclined inwardly and upwardly toward the crown for contact in use with the outer rim 22 of the container neck 20, and wherein the fin is bulbous and the central point of articulation 26 of the bulbous fin 18 is located along a line parallel to the axis to the closure and within the outer one half of the diameter of the container neck 20 with which it is to be used.

3. A container according to either preceding claim wherein the central point of articulati n 26 is locat d within the outer one third of the container neck diameter.

4. A closure according to any preceding claim wherein the articulation portion has a radial thickness greater than one quarter of the radially thickness of the bulbous portion of a fin 18.

5. A closure according to any preceding claim wherein the inclined surface of the bulbous fin at an angle to the axis of the closure of 35° to 55°.

6. A closure according to any of claims 1 to 5 wherein the distance between the underside of the crown and the remote end of the locator annulus 30 is up to 100% longer than the distance between the underside of the crown and the remote tip 19 of the fin 18.

7. A closure according to any of claims 1 to 6 wherein the remote end of the locator annulus 30 terminates in an outwardly and upwardly inclined portion 33 to present an outwardly and upwardly inclined surface to the inner rim 23 of the container neck 20 during capping.

8. A closure according to claim 7 wherein the upper end of the inclined portion of the locator annulus terminates at or adjacent a notional plane horizontal to the axis of the closure which plane is below or coincident with, the free end 19 of the bulbous fin 18.

9. A closure according to claim 8 wherein the mutually opposed inclined planes respectively of the locator annulus 33 and the bulbous fin 25 are adapted to operate sequentially on opposite sides of the rim 21 during capping.

10. A closure according to any of claims 1 to 9 wherein the angle of the inclined plane 33 of the locator annulus 30 is 25° to 35° relative t th axis f the closure.

11. A closure according to any preceding claim wherein the skirt portion terminates in a plurality of frangible bridges supporting a tamper evident band for cooperation with a plain security band on the outer neck portion of the container.

12. A closure according to any preceding claim made by injection or compression moulding.

13. An assembly of a container having a screw threaded neck and a closure according to any one of the preceding claims.

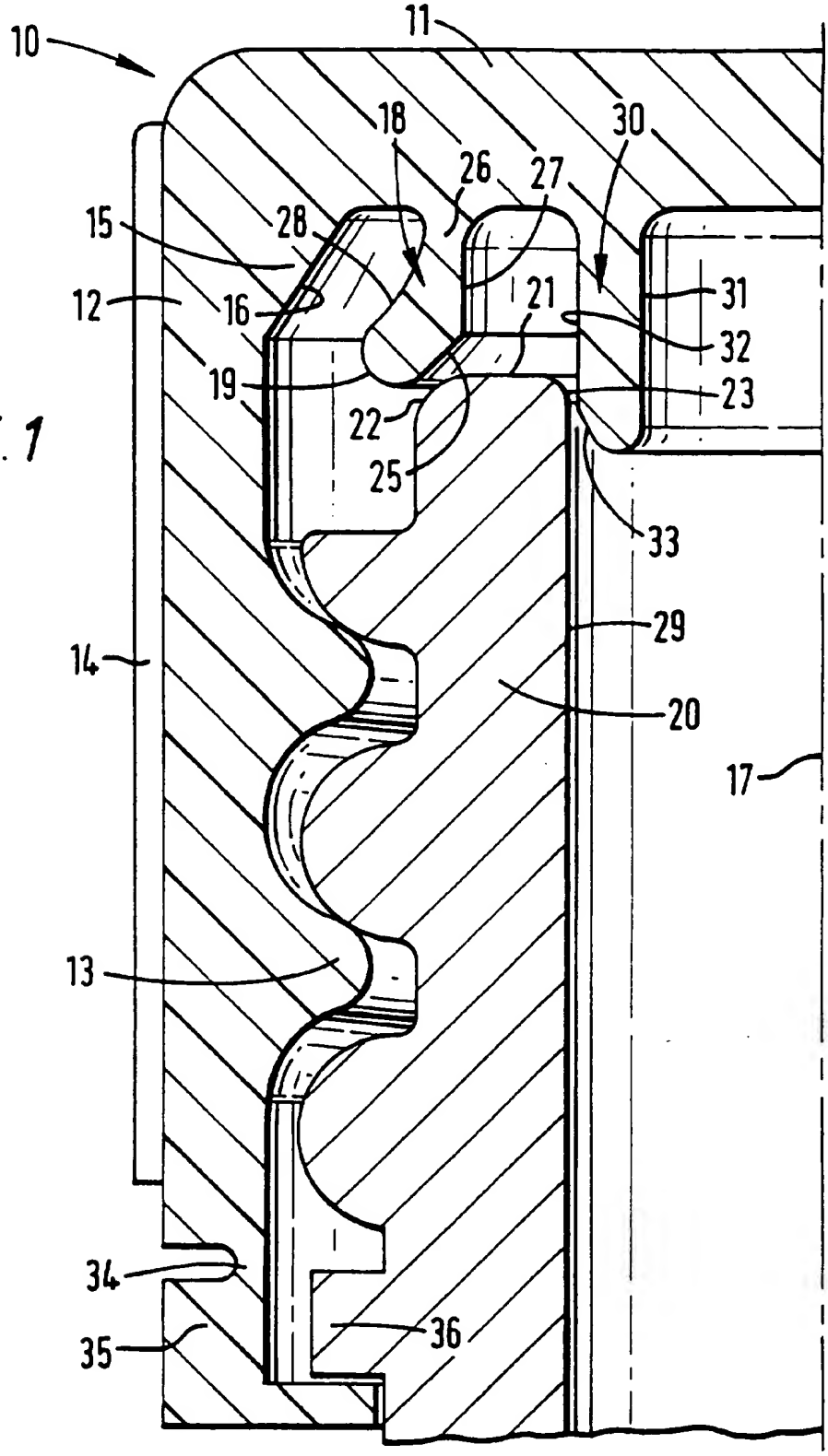
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FIG. 1

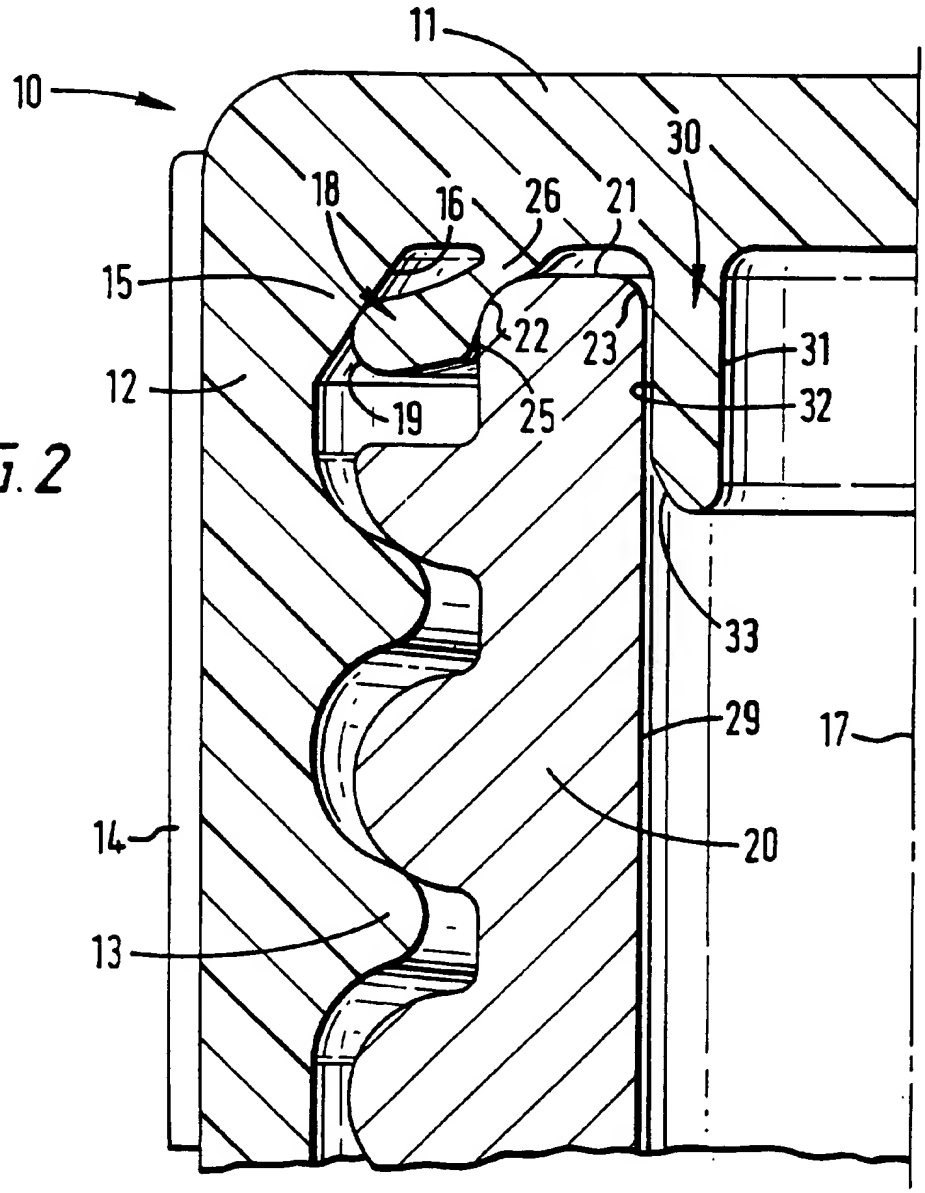

FIG. 2

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 96/00346

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65D41/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR,A,2 327 930 (ALCA S.A.) 13 May 1977 see claims; figure	1,6, 11-13
A	EP,A,0 575 987 (MOULDTEC PVG AG) 29 December 1993 see abstract; figure 1	1,11-13
A	GB,A,2 046 720 (WALTER WIEDMER AG) 19 November 1980 see abstract; figures	1,3,6,7, 10,13
A	US,A,3 067 900 (KESSLER) 11 December 1962 see column 2, line 18 - line 45; figures	2
A	EP,A,0 293 901 (METAL CLOSURES LTD.) 7 December 1988	

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 June 1996	28.06.96
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Authorized officer SERRANO GALARRAGA, J

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01/24/2003, EAST Version: 1.03.0002

INTERNATIONAL SEARCH REPORT

Inte. ..nal Application No
PCT/GB 96/00346

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP,A,0 316 167 (DAINIPPON INK AND CHEMICALS INC) 17 May 1989 ---	
A	DE,U,93 14 226 (OBERLAND GLAS AG) 26 January 1995 ---	
A	DE,A,41 35 109 (HEINRICH STOLZ GMBH) 29 April 1993 -----	

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

01/24/2003, EAST Version: 1.03.0002

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. ..tional Application No
PCT/GB 96/00346

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
FR-A-2327930	13-05-77	NONE		
EP-A-575987	29-12-93	DE-A-	4221004	05-01-94
GB-A-2046720	19-11-80	CH-A-	635795	29-04-83
		AT-B-	385013	10-02-88
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		DE-A-	3008838	16-10-80
		FR-A,B	2453086	31-10-80
		LU-A-	82315	02-07-80
		NL-A-	8001835	07-10-80
US-A-3067900	11-12-62	NONE		
EP-A-293901	07-12-88	AU-B-	570997	31-03-88
		AU-B-	3227584	28-02-85
		CA-A-	1282033	26-03-91
		EP-A,B	0136088	03-04-85
		JP-A-	60068256	18-04-85
		US-A-	4526284	02-07-85
EP-A-316167	17-05-89	JP-A-	1139348	31-05-89
		US-A-	4907709	13-03-90
DE-U-9314226	26-01-95	NONE		
DE-A-4135109	29-04-93	NONE		

01/24/2003, EAST Version: 1.03.0002

US005133471A

United States Patent [19]

Pujol Almirall

[11] Patent Number: 5,133,471

[45] Date of Patent: Jul. 28, 1992

[54] **STOP DEVICES FOR CAP THREADS**

[75] Inventor: **Juan Pujol Almirall**, Viladecans, Spain

[73] Assignee: **Ultimos Desarrollos, S.A.**, Barcelona, Spain

[21] Appl. No.: **732,999**

[22] Filed: **Jul. 18, 1991**

[30] **Foreign Application Priority Data**

Mar. 14, 1989 [ES] Spain 8900826

[51] **Int. Cl.**[5] **B65D 41/04**

[52] **U.S. Cl.** **215/331**; 215/252; 215/354

[58] **Field of Search** 215/331, 354, 252

[56] **References Cited**

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Primary Examiner—Stephen P. Garbe
Assistant Examiner—Stephen Cronin
Attorney, Agent, or Firm—Darby & Darby

[57] **ABSTRACT**

The stop device for cap threads is preferably applicable to plastic caps which are coupled by screwing on the corresponding neck of a bottle containing liquids.

The device consists of a thickening or projection (8) provided in the inner part of the cap (1), specifically in the intersection part between the side surface of said cap and the bottom of the same. When the cap (1) is screwed on the neck of the bottle this thickening (8) stops against the first thread (2') which the neck of the bottle has, constituting an obstacle resistant enough to prevent the cap (1) in its last screwing phase from continuing screwing on the neck.

8 Claims, 1 Drawing Sheet

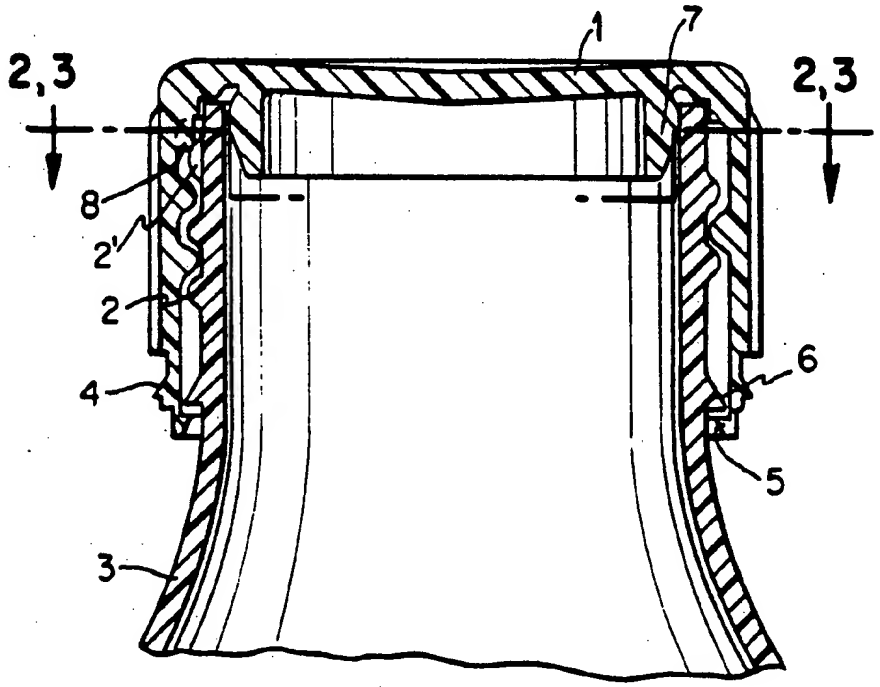

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FIG. 1

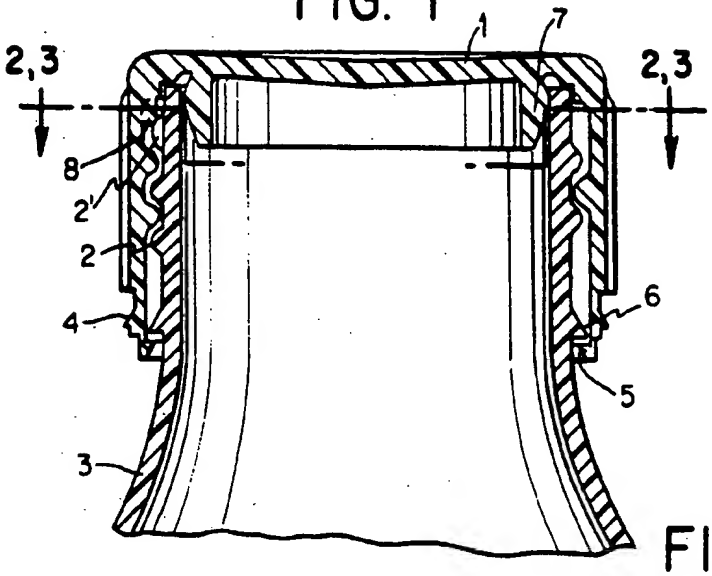


FIG. 2

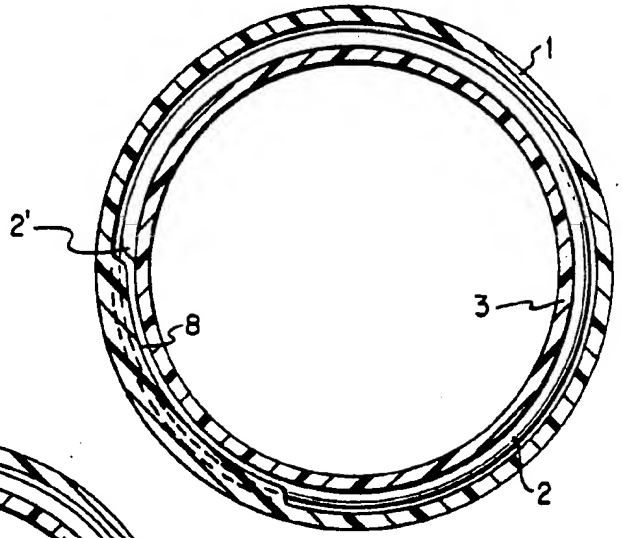
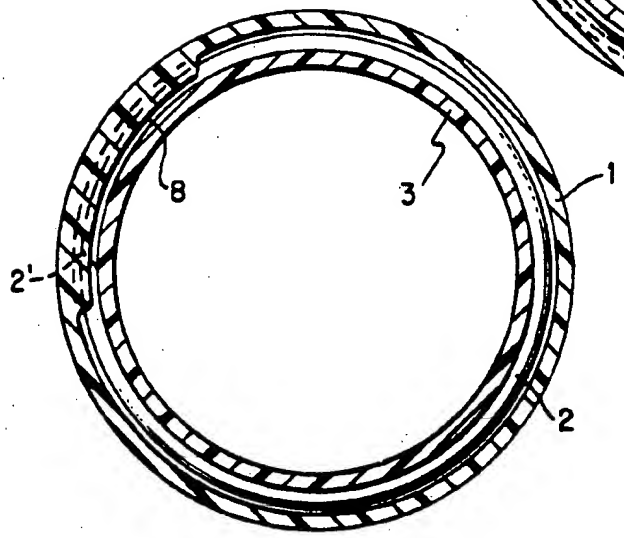


FIG. 3



STOP DEVICES FOR CAP THREADS

This is a continuation of application Ser. No. 492,977, filed Mar. 12, 1990 now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a stop device for cap threads, which has been conceived and made in order to prevent the cap from screwing beyond some pre-established limits.

The stop device is applicable to the type of caps made out of plastic and which screw on a neck of bottles which preferably contain carbonated products, such as soft drinks and the like.

2. Description of the Related Art

By exerting a moderate rotating force while screwing a plastic cap onto a bottle neck, the resistance of the threads of the bottle and of the cap itself becomes exceeded after reusing the cap several times and the so-called state of a "crossed thread" is reaohed. Thus, the cap and the bottle become useless. Further, on occasions the contents or the carbon dioxide leak and this has corresponding negative consequences.

In view of this, some standards of quality were set down which should be met by this type of cap. These standards of quality established some minimal forces which all caps used to seal bottles for liquids should resist.

Now then, due to the nature of the material used to make caps, it is unquestionable that at certain temperatures the required standards of quality can be met on the basis of a specific size and design of the cap. Above a certain temperature, and due to the nature of the material, the same force as before will now cause in these conditions of higher temperature the thread to no longer fit properly.

Therefore, cap manufacturers have been forced to oversize the whole and this involves technical and economic inconvenience.

SUMMARY OF THE INVENTION

The cap of the invention includes a stop device which definitively solves the problems cited above and all of this without the temperature having an influence on the greater or lesser effectiveness of the system.

In this sense, the stop that the cap has remains placed at the pitch of the thread of the neck of the bottle, preventing the cap from continuing to screw before a side overforce on the threads is reached.

The stop device is applicable to plastic caps, and specifically to those that form a cap type body with an inner thread for its coupling to the inner thread of the bottle. The cap is conveniently provided on its bottom edge with the respective sealing ring, which includes a tooth which interlocks in a transversal rib of the bottle.

Likewise, this cap has an inner ring-shaped flange or partition for its adjustment to the mouth of the bottle. In other words, the top edge of the bottle remains inserted between the flange or ooncentric partition and the side surface of the oap.

As to the stop device itself, the same consists of a thickening located in the inner contour of the cap, preferably in correspondence with the inner edge established between the bottom and the flap or inner flange of the cap. This is all for the purpose of keeping the thickening placed at the pitch of the first single thread of the neck of the bottle. The thickening determines an obstaole resistant to the turning of the cap in the last screwing phase.

Preferably, the stop covers an arc of approximately 75° and its inner radius has to be less than half of the outer diameter of the thread of the neck of the bottle.

In order to complement the description which is going to be made hereinafter and for the purpose of providing a better understanding of the characteristics of the invention, reference is made to the accompanying drawings and following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a sectional view, according to a vertical and diametrical plane of the cap coupled to the neck of a bottle. The oap includes the stop device made in accordance with the invention.

FIG. 2 shows a ,sectional view, in acoordance with a horizontal plane across section lines 2—2 of FIG. 1, in other words, perpendicular to the axial axis of the whole which constitutes the coupling between the cap and the neck of the bottle, prior to engagement.

FIG. 3 shows a sectional view as in FIG. 2 across section lines 3—3 of FIG. 1, but after engagement.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a plastic cap 1 that is screwed on the oorresponding single thread 2 provided on the neck of a bottle 3, with the particular feature that the latter is to contain liquids, such as soft drinks or the like.

The cap is conventionally complemented, in correspondence with its bottom edge, with a sealing ring 4 provided with a ring-shaped tooth 5, which interlooks in the transversal rib 6 of the bottle 3. In the bottom of the cap there is a flap or concentric partition 7, between which and the inside side surface of the cap fits the top edge of the neck of the bottle 3.

The stop device consists of a thickening 9 provided in correspondence with the inner contour of the cap 1, preferably in the inner edge established between the bottom and the flap or concentric partition 7, as one oan see very well in the left part of FIGS. 1 and 2.

FIG. 3 shows engagement of the thickened portion 8 and bottle neck thread portion 2, along most of the length of the thickened portion 8.

The thickening 8 is placed at the pitch of the first section 2' of the thread 2 of the neck of the bottle 3, determining an obstacle resistant to the turning of the cap in the last screwing phase. Further, this thickening 8 covers an arc of approximately 75° and has a bottom inner radius half the outer diameter of the thread 2 of the neck of the bottle 3.

In this way, when the cap 1 is screwed on the neck of the bottle 3, a point will be reaohed in which the first section of the thread 2' will be at the thickening 8, impeding its advance until reaching a resistance such that the force needed to continue screwing on the cap by hand exceeds that which is established as the quality standard.

In order to reach such a resistance, it follows that the thickened portion or thickening 8 engages an inoreasing area of the bottle thread as the oap oontinues to be screwed onto the bottle neck beyond an extent of threadable engagement where sealing takes place. As engagement of this increasing area takes place, resistance increases against further turning of the cap on the bottle neck until reaching the resistance which satisfies

01/24/2003, EAST Version: 1.03.0002

the standard of quality, e.g., that which prevents the cap from reaching a relative position on the bottle neck where the cap and bottle threads would be in a crossed thread state.

Logically, the force is borne only by the thickening 8 and by the first section 2' of the thread 2 corresponding to the bottle 3, all in such a way that the threads of the bottle and of course the ones of the cap will not bear any side overpressure. This attains an indefinite duration of the sealing of the cap and a guaranteed conserving of the contained liquid, also avoiding all risks of leakage.

I claim:

1. An apparatus which impedes screwing beyond an extent of threading engagement, comprising:

a cap threaded inside at a pitch that is threadably engageable with a pitch of an engaging thread on a bottle neck;

means for sealing said cap to a mouth of a bottle as soon as said cap threadably engages said bottle neck by an extent of threadable engagement, said cap being manually screwable further onto said bottle neck beyond said extent; and

means for impeding further screwing of said cap onto said bottle neck when screwing beyond said extent, said impeding means including a thickened portion projecting from said cap into a position where said thickened portion engages an increasing area of the thread on the bottle neck as said cap continues to be screwed beyond said extent so as to increase resistance against further turning of said cap on said bottle neck until reaching a resistance which prevents said cap from being manually turned any further and which prevents said cap from reaching a relative position on said bottle neck where said cap and bottle threads would be in a crossed thread state.

2. An apparatus as in claim 1, further comprising a sealing ring on said cap and a transverse rib on said bottle neck which sealingly engage each other as soon as said extent of said threadable engagement is reached.

3. An apparatus as in claim 2, wherein said sealing ring includes a ring-shaped tooth which engages with said transversal rib.

4. An apparatus as in claim 2, wherein said thickened portion extends about an inner circumference of said cap by an arc of approximately 75 degrees, said thickened portion having an inner radius which is less than half an outer diameter of the thread on the bottle neck.

5. An apparatus as in claim 2, where said cap includes base and skirt portions, said skirt portion extending from said base portion, said threads of said cap being on said skirt portion, said sealing means including a flange which projects from said base portion at a location radially inside of said skirt portion, said flange being against an inner circumference of a mouth of the bottle neck as said cap is screwed onto said bottle neck to said extent.

6. An apparatus as in claim 1, wherein said cap includes base and skirt portions, said skirt portion extending from said base portion, said threads of said cap being on said skirt portion, said sealing means including a flange which projects from said base portion at a location radially inside of said skirt portion.

7. An apparatus as in claim 6, wherein said thickening extends between said skirt portion and said flange.

8. An apparatus as in claim 1, wherein said thickened portion extends about an inner circumference of said cap by an arc of approximately 75 degrees.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,133,471
DATED : July 28, 1992
INVENTOR(S) : Juan Pujol Almirall

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

On the title page:

After "[22] filed: Jul. 18, 1991" insert the following:

--[62] Related U.S. application data
Continuation of Ser. No. 492,977,
Mar. 12, 1990, abandoned--

Signed and Sealed this
Fifteenth Day of March, 1994

Attest:

Bruce Lehman

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

US006044995A

United States Patent [19]

Dai

[11] Patent Number: 6,044,995

[45] Date of Patent: Apr. 4, 2000

[54] **NEGATIVE-PRESSURE-RESISTIBLE LEAKAGE-PROOF BOTTLE COVER**

[75] Inventor: **Keith Hon-Chuan Dai**, Taichung, Taiwan

[73] Assignee: **Taiwan Hon Chuan Enterprise Co., Ltd.**, Taichung, Taiwan

[21] Appl. No.: **09/158,139**

[22] Filed: **Sep. 22, 1998**

[51] **Int. Cl.**[7] **B65D 41/34**

[52] **U.S. Cl.** **215/354**; 215/341; 215/252

[58] **Field of Search** 215/354, 252, 215/320, 341, 342, 343, 349, 350

[56] **References Cited**

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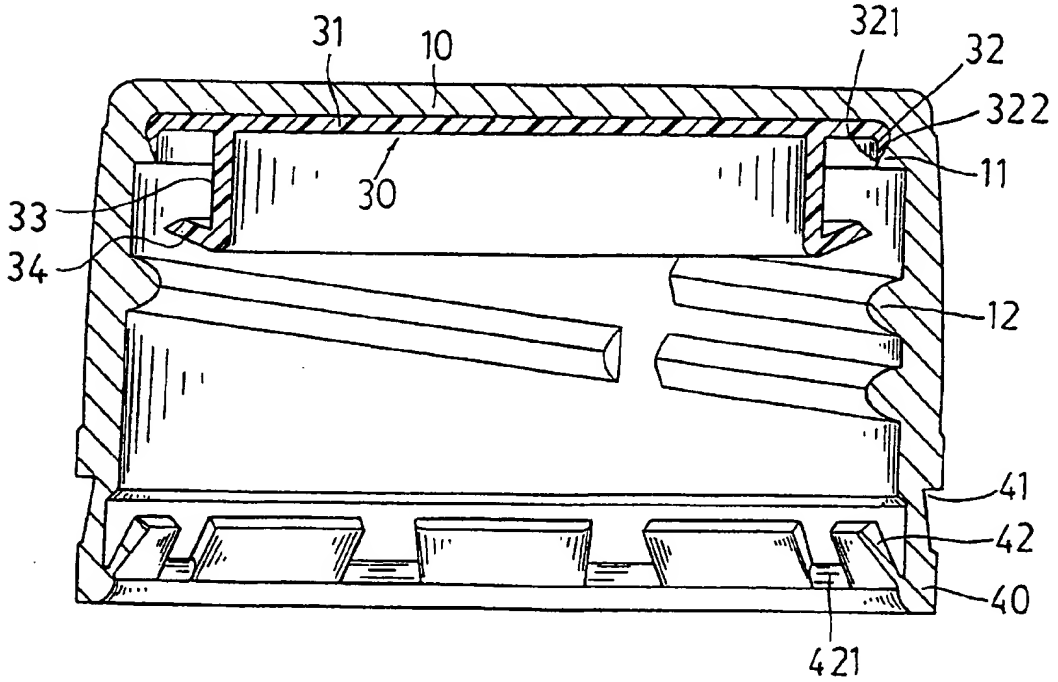
Primary Examiner—Allan N. Shoap
Assistant Examiner—Robin A Hylton
Attorney, Agent, or Firm—Bacon & Thomas

[57] **ABSTRACT**

A negative-pressure-resistible leakage-proof bottle cover, wherein a leakage-proof gasket is disposed. A circular main body of the leakage-proof gasket is stuck onto inner top face of a cover body, wherein an extended positioning circumferential edge is commensurate with a confining stopper of the cover body. The bottom face of the leakage-proof gasket is extended to form an infiltration resister, whereof the open end is further extended in out- and- up direction to form an infiltration-resisting ring. At a lower portion of the cover body, an anti-tampering ring is arranged, wherein a plurality of seamless cutting lines is round-set and a bridge point is formed in each of the seamless cutting lines. In the anti-burglar ring, a plurality of protruded stopping pieces is disposed, wherein between two neighboring protruded stopping pieces, a consecutive wall is extended from an inner edge of the anti-tampering ring, and further, the consecutive wall is pinched by and connected to two neighboring protruded stopping pieces.

1 Claim, 5 Drawing Sheets



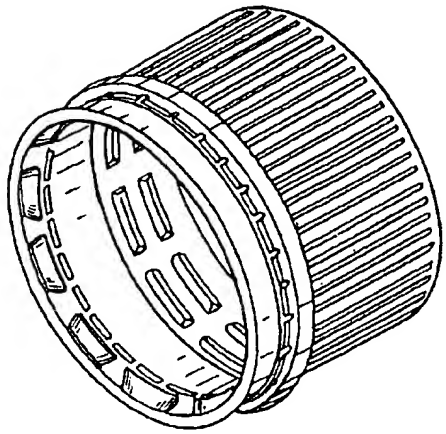


Fig. 1 PRIOR ART

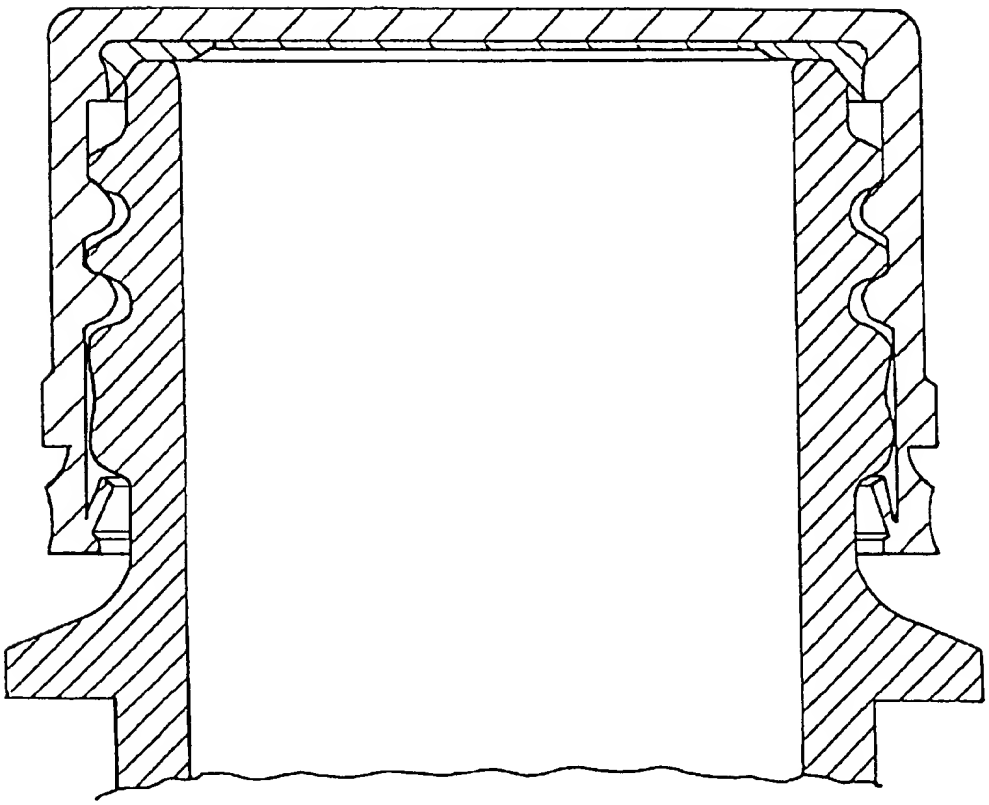


Fig. 2 PRIOR ART

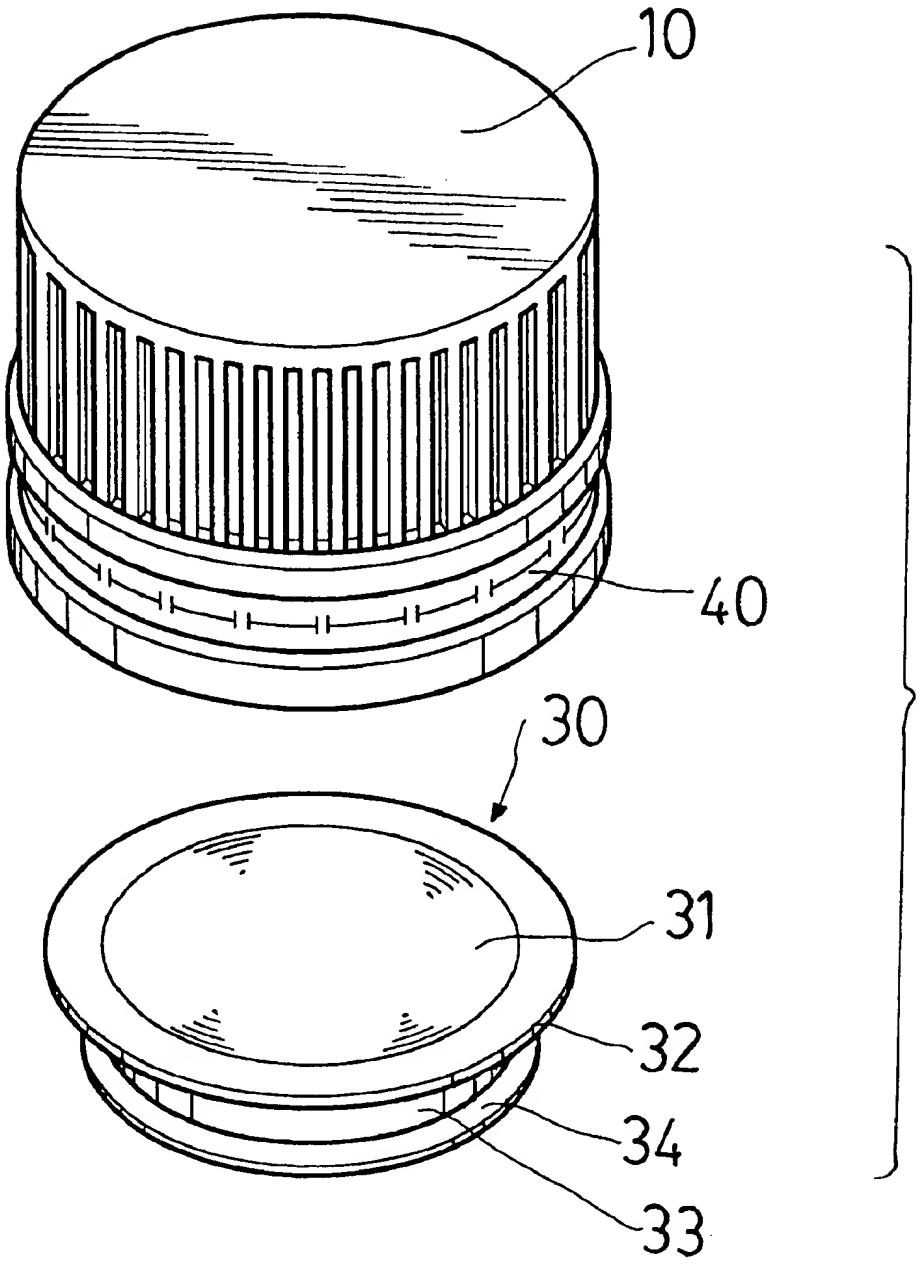


Fig. 3

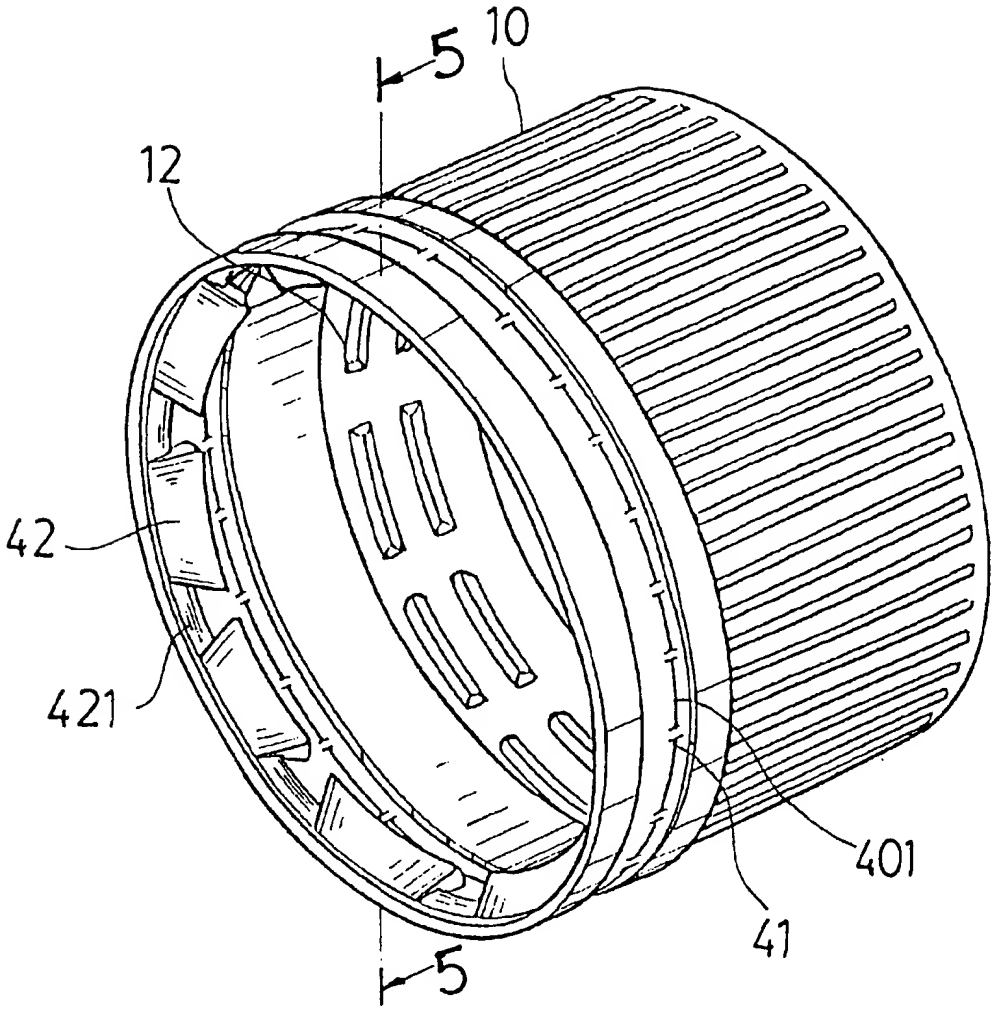


Fig. 4

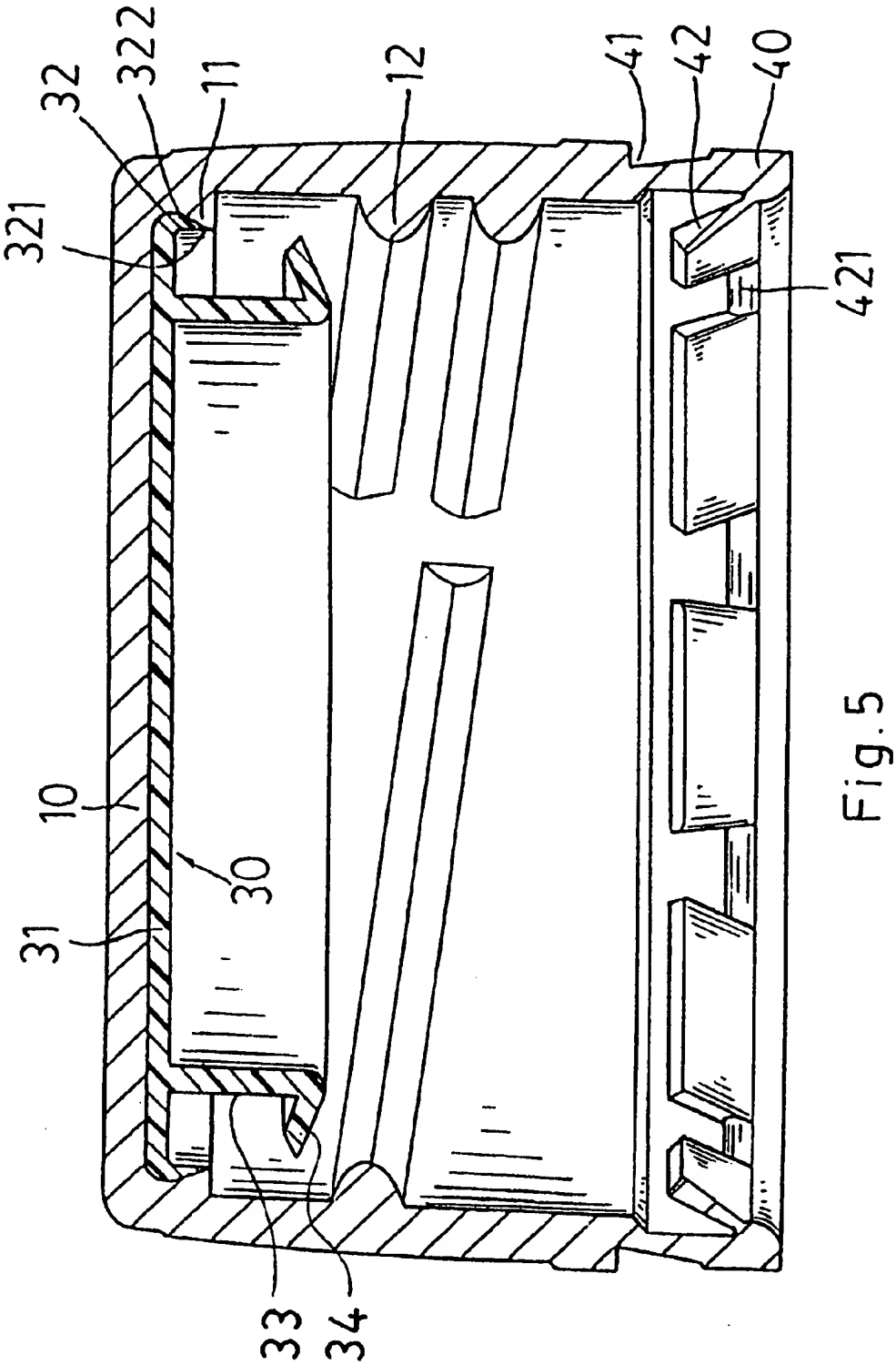


Fig.5

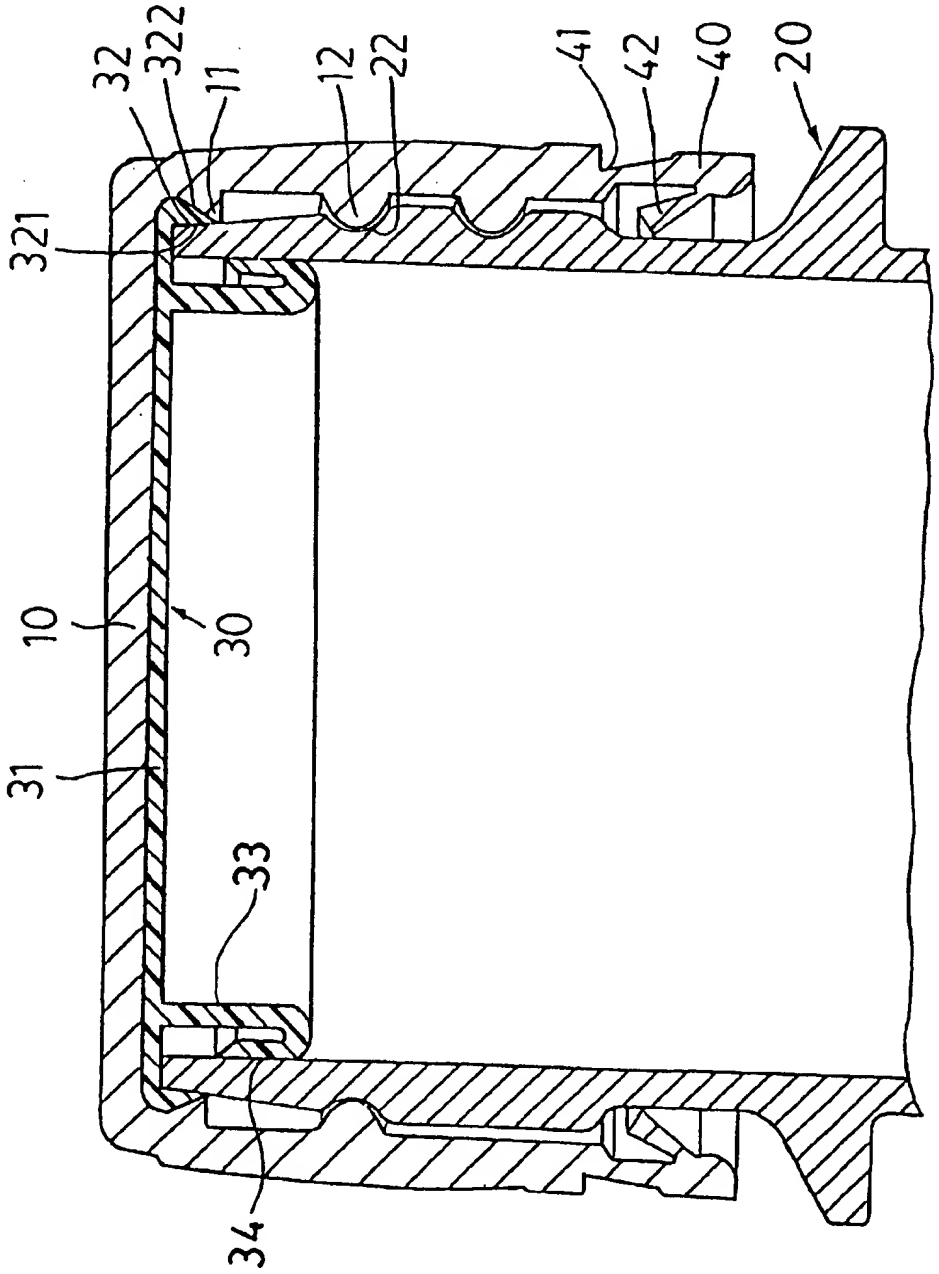


Fig.6

NEGATIVE-PRESSURE-RESISTIBLE LEAKAGE-PROOF BOTTLE COVER

BACKGROUND OF THE INVENTION

The invention relates to a bottle cover and, more particularly, to the structure of a negative-pressure-resistible leakage-proof bottle cover.

The structure of a common bottle cover is shown in FIGS. 1 and 2. A plurality of threads are formed at an inner edge of a cover body serving as a female connector to match those on a bottle mouth serving as a male connector for a firm engagement. In the cover body, an anti-tampering ring is provided at a lower position and a leakage-proof gasket is provided on an inner top face.

The leakage-proof gasket is circular and formed from an elastomer that is processed from thermoplastic materials. It is designed thicker at the circumference than at the center. The circumferential portion is bent downward and is slightly extended and converged to form a single circular edge to deform at protrusions on an inner wall of the bottle body for positioning when the leakage-proof gasket is pressed onto the inner top face of the bottle cover.

This known leakage-proof gasket has a disadvantage in that the gasket is thickened at its circumference, and since both the contact faces of the gasket and the top edge of a bottle mouth are planer, a relatively larger torque force will be required for sealing the bottle mouth. It is rather a inconvenient, or even harmful to a user. In case a bottle filled with a beverage at 85° C. or higher becomes cold, a negative pressure will be created in the bottle, so that air will infiltrate into the bottle. This is why a common bottle cover cannot withstand the effect of negative-pressure.

The integral molded anti-tampering ring located around the open end of the cover body with a relatively smaller inner diameter than that of the opening, connects to the cover body via intermittently spaced gaps and strips. Several choke fins are round-set at an inner side of the anti-tampering ring for clutching at the bottom edge of threads formed at an outer side of the bottle mouth. The thickness of the anti-tampering ring is about equal to that of the cover body, and, when sealing, the ring is subjected to downward and outward pressures from the cover body and threads at the bottle mouth. It cannot pass smoothly over the threaded section and may become deformed and torn. The intermittently spaced strips are liable to be broken.

SUMMARY OF THE INVENTION

The invention provides a negative-pressure-resistible leakage-proof gasket equipped bottle cover, wherein the leakage-proof gasket offers a function of dual-stage leakage-proofing and negative-pressure-resisting.

Another objective of the invention is to provide a negative pressure-resistible leakage-proof gasket equipped bottle cover and, wherein the anti-tampering ring is located at lower portion of the bottle cover where it cannot be easily broken.

To realize the above objects of the invention, there is provided on the inner top face of the cover body, a leakage-proof gasket circular gasket having a positioning circumferential edge commensurate with a confining stopper in the cover body. An infiltration resister is extended downward from a bottom face of the gasket for a length, then bent in an outwardly and upwardly direction to form an infiltration-resisting ring. An anti-tampering ring with a plurality of seamless cutting lines is provided at a lower portion of the cover body, wherein a bridge point is formed in each cutting line. In the anti-tampering ring, a plurality of protruded stopping pieces are formed and a consecutive wall is provided between to neighboring protruded stopping pieces extending from an inner edge of the anti-tampering ring.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a known common bottle cover.

FIG. **2** is a sectional view showing the combination of a known bottle cover and a bottle mouth.

FIG. **3** is an exploded perspective view of the invention.

FIG. **4** is a perspective view of the invention.

FIG. **5** is a sectional view along the line **5**—**5** in FIG. **4**.

FIG. **6** is a sectional view showing the combination of the invention and a bottle mouth.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIGS. **3** through **6**, the structure of a bottle cover of the invention mainly comprises a cover body **10**, an integral molded anti-tampering ring **40** at a lower portion of the cover body **10**, a confining stopper **11** viewed as a triangular protrusion in cutaway section on an inner wall near the top end of the cover body **10**, and a plurality of threads **12** on a side wall of the cover body **10** corresponding with a plurality of threads **22** formed along an outer side of a bottle mouth **21** of a bottle body **20**.

A leakage-proof gasket **30** is made from an elastic material, a material different from that of the cover body **10**, and having a circular main body **31** at outer diameter corresponding to the inner diameter at the top of the cover body **10**. Gasket **30** is disposed on an inner top face of the cover body **10**. The circumferential edge of the circular main body **31** is bent and extended downward to form a positioning circumferential edge **32**, wherein an inner plain face **321** is substantially perpendicular to the circular main body **31**, while an outer side face **322** is sloped to match the confining stopper **11**. When the leakage-proof gasket is pressed onto the inner top face of the integral molded cover body **10**, the sloped face **322** corresponds with the confining stopper **11** for purpose of positioning. The bottom face of the leakage-proof gasket **30** is located at a position corresponding to that of an inner edge of the bottle mouth **21** and is extended downward to form an infiltration resister **33**, which is further extended from its open end in an outward and upward direction to form an infiltration- resisting ring **34**.

A plurality of seamless cutting lines **401** are provided between an anti-tampering ring **40** and the cover body **10**, and a bridge point **41** is provided between each two seamless cutting lines **401**. The anti-tampering ring **40** being slightly longer than the cover body **10** in inner diameter, but thinner in thickness, is extended from an inner face at its open end in an inwardly and upwardly direction to form a plurality of stopping pieces **42**.

A plurality of consecutive walls **421** with same thickness as that of the protruded stopping pieces **42** are extended from inner edge of the anti-tampering ring **40**. Each consecutive wall **421** connects two neighboring protruded stopping pieces **42** side by side to form a serial root connection.

In sealing the cover body **10** to the bottle mouth **21**, the top edge of the bottle mouth **21** engages and deforms the infiltration-resisting ring **34** and urges same toward the infiltration resister **33**. After sealing is made, the top edge of the bottle mouth **21** will locate at a position between the

positioning circumferential edge **32** and the infiltration resister **33**. Meanwhile, the outer edge of the bottle mouth **21** engages intimately against the plain face **321** at the inner side of positioning circumferential edge **32**, and the infiltration-resisting ring **34** sticks firmly against the inner wall of the bottle mouth **21** due to the elastic restoring force of ring **34**. The ends of the protruded stopping pieces **42** are urged against the lowest position of the thread section of the bottle mouth **21**.

Due to a dual connection of the protruded stopping pieces **42** to the cover body **10**, including root connection to the inner edge of the cover body **10** and a mutual connection via the consecutive walls **421**, the construction will not be broken or destroyed easily by a squeezing or pulling force during sealing of the cover body **10** onto the bottle mouth **21** or removal after the molding process. After sealing, each free end of the protruded stopping pieces **42** engaging the thread section of the bottle mouth **21** at the lowest position will effectively prevent the cover body **10** from falling off. The bridge points **41** will be fractured for easy opening as soon as the cover body **10** is turned. The seamless cutting lines **401** are formed for detachment of the anti-tampering ring **40** from the cover body **10** for an easy opening. During sealing, because of downward pressure from the cover body **10**, the seamless cutting lines **401** contract to allow contact of the anti-tampering ring **40** to the round edge of the cover body **10** and relieve loading at the bridge points **41** to avoid fracture.

The invention provides a dual function leakage-proving. The infiltration-resisting ring **34** is elastically attached firmly to the inner edge of the bottle mouth **21** to prevent the air in the bottle from escaping through any opening in the leakage-proof gasket **30** to ensure the first stage leakage-proofing. The plain face **321** at the inner side of the positioning circumferential edge **32** attached firmly to the outer edge of the bottle mouth **21**, and the slope **322** being commensurate with the confining stopper **11**, together form a barrier for the second stage leakage proofing. With the dual protection measures, it is possible to reduce the torque force required to open a bottle and to ensure an excellent sealing for keeping foods fresh and safe.

In addition, the leakage-proof gasket **30** of the invention is capable of withstanding a negative pressure. In the event the bottle body **20** is filled with hot foods at 85° C. or higher, a negative pressure in the bottle will be created when the temperature is reduced. Then, the outside air shall attempt to infiltrate into the bottle through any openings available between the cover body **10** and the bottle mouth **21**, due to the relatively larger atmospheric pressure. However, because of the tight squeezing of the slope **322** of the positioning circumferential edge **32** against the confining stopper **11**, the outside air is prevented from entering the first stage negative-pressure-resistance effect. Further, the infiltration-resisting ring **34** can also resist a negative pressure because the elastic restoring force of the infiltration-resisting ring **34** urges the ring **34** against the inner edge of the bottle mouth **21**, so that, even if some air exists between the infiltration resister **33** and the infiltration-resisting ring **34**, the pressure produced will further push the infiltration-resisting ring **34** against the inner edge of the bottle mouth **21** and prevent the outside air from entering.

What is claimed is:

1. A negative-pressure-resistible leakage-proof bottle cover, comprising:

a cover body, a leakage-proofgasket disposed on an inner top face in said cover body, said leakage-proof gasket having a circular main body with an outer diameter corresponding to an inner diameter of the top face of said cover body, said circular main body having a circumferential edge turned downward and extended to form a positioning circumferential edge, said positioning circumferential edge having an inner face at an inner side and a sloped face at an outer side, said leakage-proof gasket having a bottom face extended downward to form an infiltration resister, said infiltration resister having an open end extended in an outward and upward direction to form an infiltration-resisting ring; and

an anti-tampering ring disposed circumferentially around an open end of said cover body and having a plurality of oblique protruded stopping pieces arranged at an inner edge thereof, a plurality of cutting lines disposed between said anti-tampering ring and said cover body, each of said seamless cutting lines having a bridge point, a consecutive wall being extended from an inner edge of said anti-tampering ring between each two adjacent protruded stopping pieces, said consecutive wall being pinched by and connected to adjacent protruded stopping pieces in a side by side manner to form a serial connection at the roots of said protruded stopping pieces.

* * * * *

US005964363A

United States Patent [19]

Kelly et al.

[11] Patent Number: 5,964,363

[45] Date of Patent: Oct. 12, 1999

[54] TAMPER EVIDENT BOTTLE CAP

[75] Inventors: **Ronald L. Kelly**, Chester, Va.; **Michael T. Vavrik**, Oak Forest, Ill.; **Lino Dreyer**, Saint-Louis, France

[73] Assignee: **Crown Cork & Seal Technologies Corporation**, Alsip, Ill.

[21] Appl. No.: **08/930,646**

[22] PCT Filed: **Apr. 2, 1996**

[86] PCT No.: **PCT/EP96/01447**

§ 371 Date: **Feb. 2, 1998**

§ 102(e) Date: **Feb. 2, 1998**

[87] PCT Pub. No.: **WO96/31404**

PCT Pub. Date: **Oct. 10, 1996**

Related U.S. Application Data

[63] Continuation of application No. 08/616,524, Mar. 19, 1996, abandoned.

[30] **Foreign Application Priority Data**

Apr. 5, 1995 [CH] Switzerland 977/953

[51] **Int. Cl.**[6] **B65D 41/34**

[52] **U.S. Cl.** **215/252**

[58] **Field of Search** 215/252, 256, 215/258

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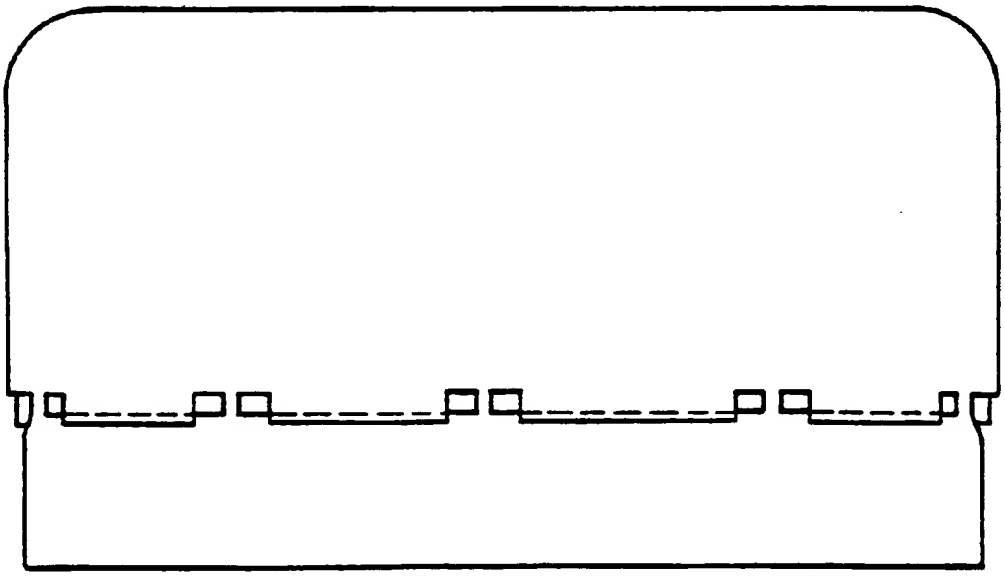
Primary Examiner—Stephen K. Cronin
Assistant Examiner—Nathan Newhouse
Attorney, Agent, or Firm—Woodcock Washburn Kurtz Mackiewicz & Norris LLP

[57] **ABSTRACT**

A compression failure resistant tamper evident bottle cap includes a skirt with a lower edge, and a tamper-evident band formed integrally with the skirt and having structure for engaging beneath a retaining flange on the bottle so as to prevent subsequent withdrawal of the band. Frangible bridges connect the band to the lower edge of the skirt. To prevent destruction of the bridges as the cap is forced onto the bottle during installation, the skirt has one or more tabs or the like, extending downward over a portion of the band, for preventing undue diametral expansion of the tamper evident band as it passes over the retaining flange.

1 Claim, 5 Drawing Sheets



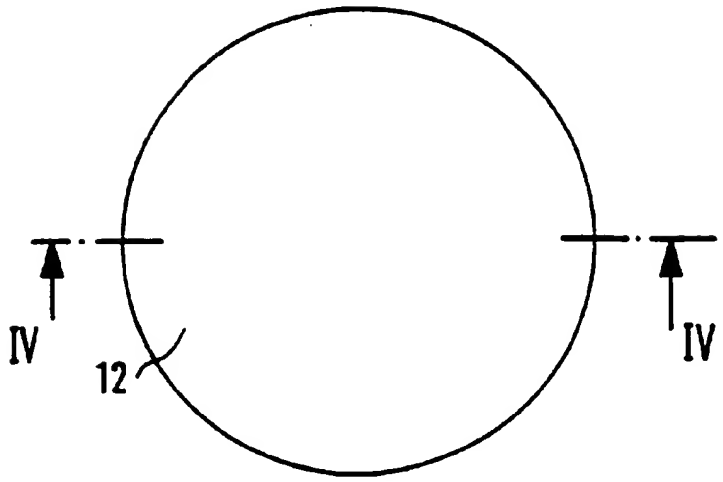


FIG.1

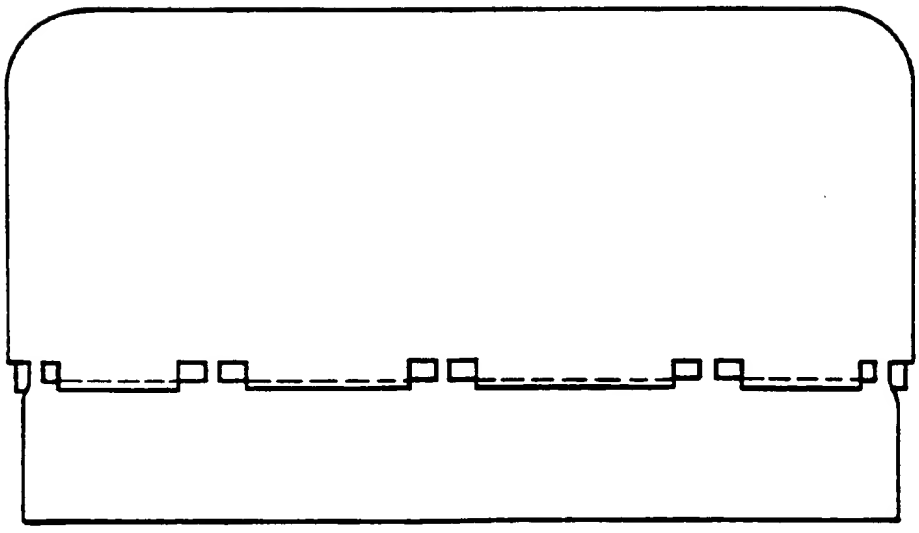


FIG.2

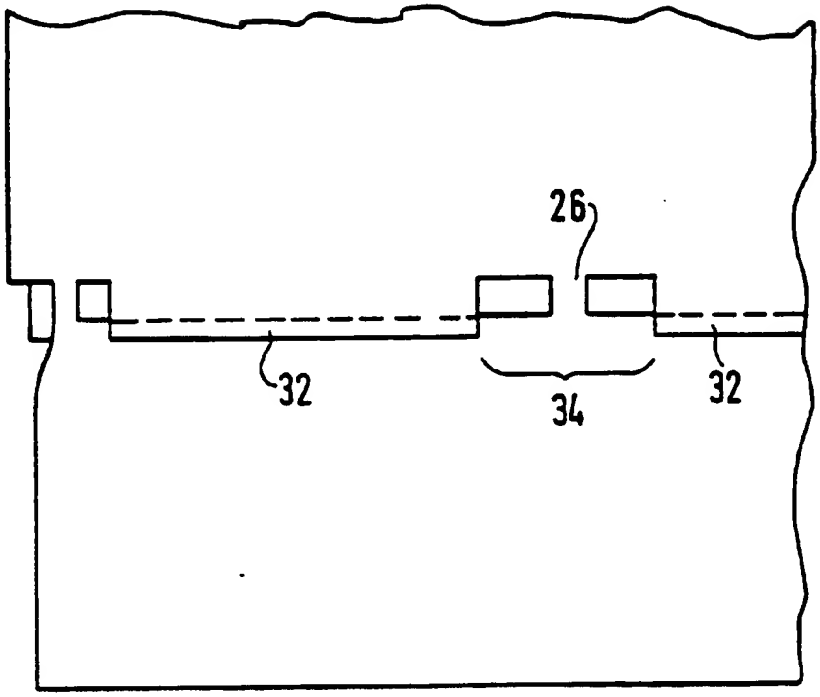


FIG. 3

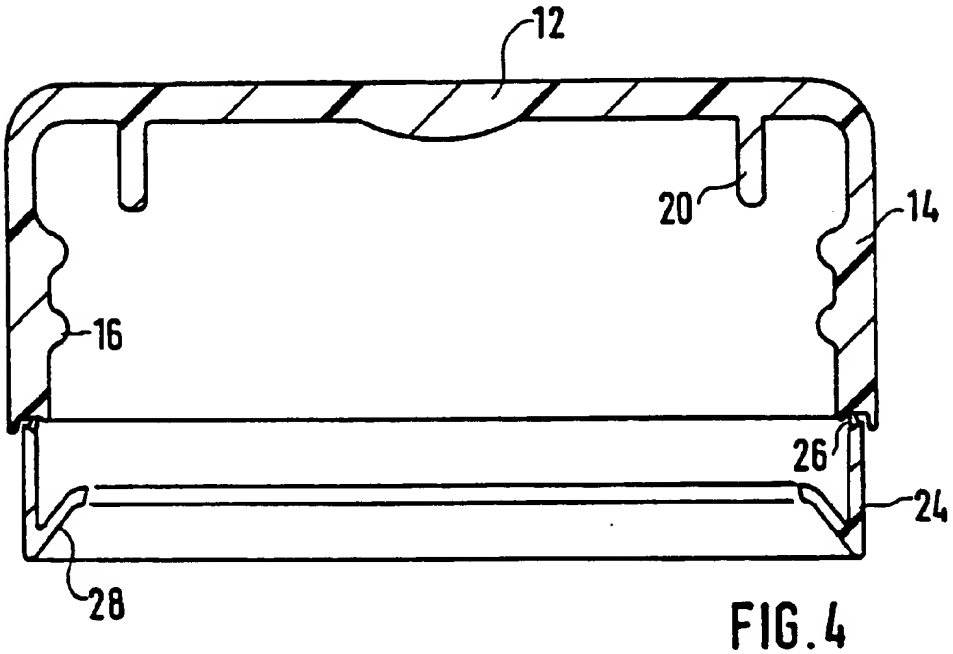


FIG. 4

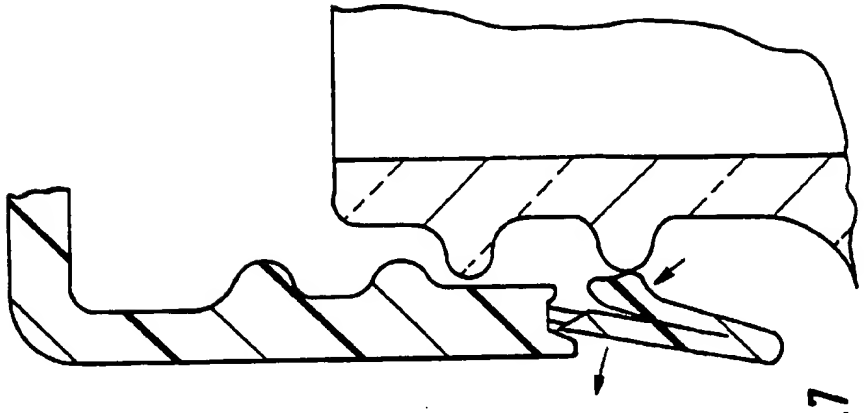


FIG.7

FIG.6

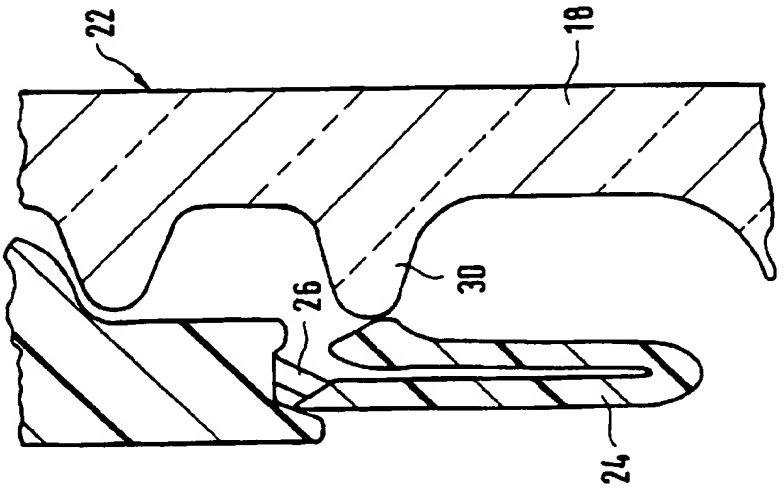


FIG.5

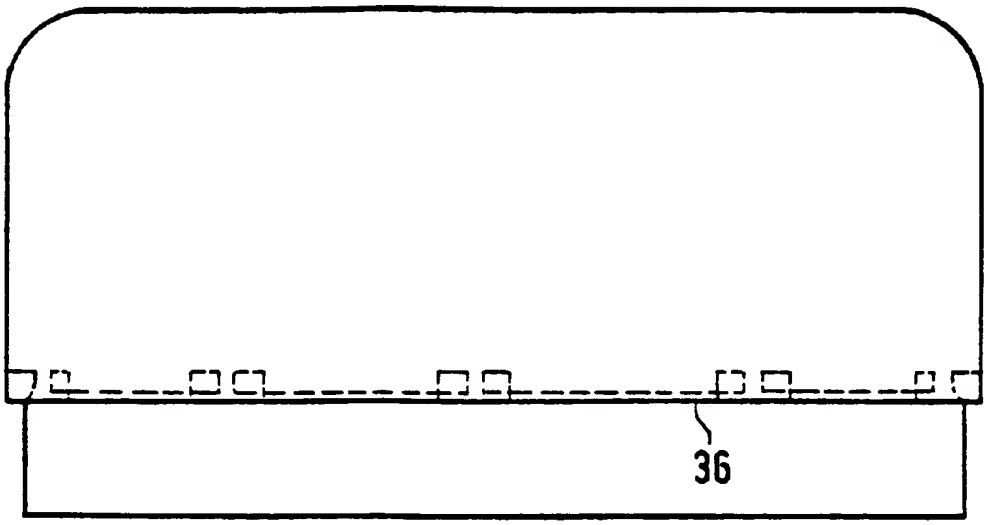


FIG. 8

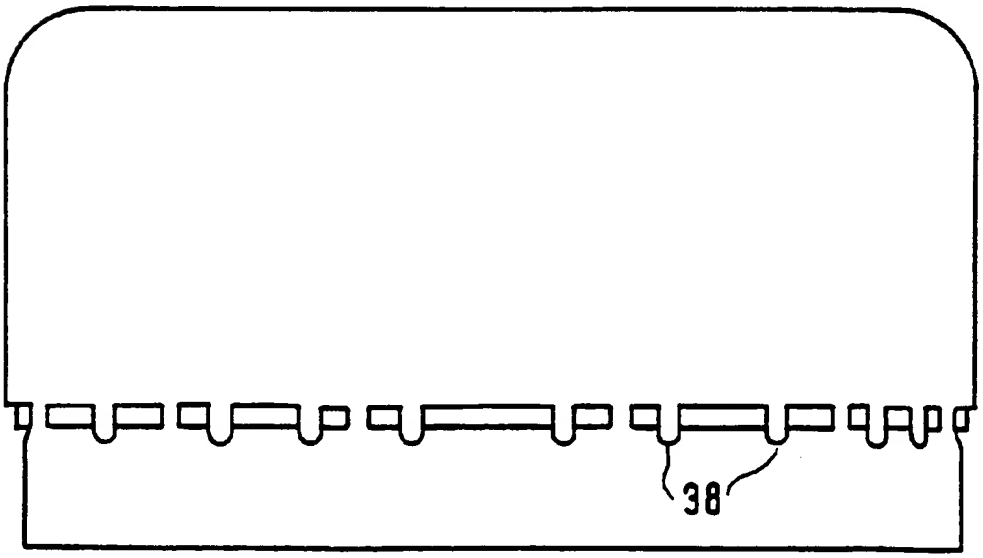


FIG. 9

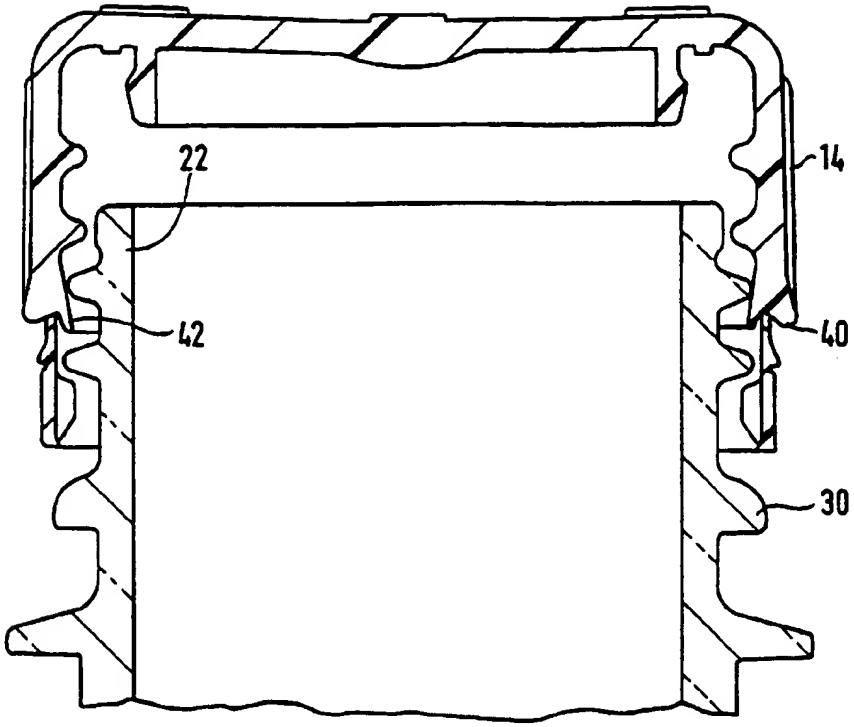
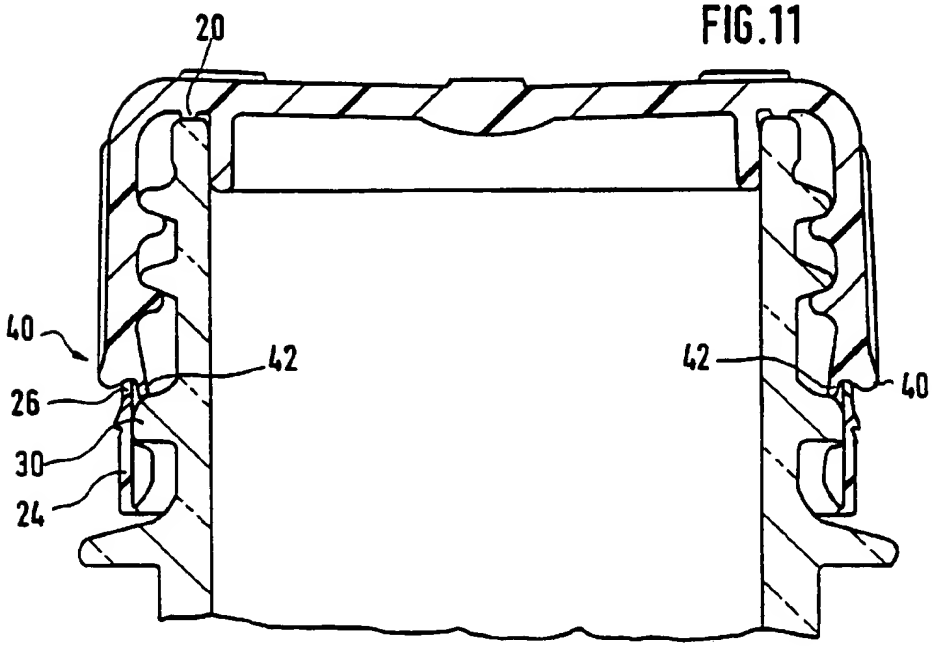


FIG.10

FIG.11



TAMPER EVIDENT BOTTLE CAP

This application is a continuation of U.S. Ser. No. 08/616,524, filed Mar. 19, 1996, now abandoned

BACKGROUND OF THE INVENTION

This invention relates to the art of bottle closures, and more particularly to a compression failure resistant tamper evident bottle cap.

Nowadays, many bottle caps have a band which tears away from the rest of the cap, remaining with the bottle neck, when the cap is removed for the first time. One can visually, or by feel, detect when such a cap has been removed and then reinstalled, because of the failure of the anti-tamper feature. Such caps, once made of metal, now are usually molded from a plastic polymer.

The tamper-evident band is normally smaller in diameter than a retaining flange on the bottle finish, and is pushed over the retaining flange at the factory when the cap is installed. The band is connected to the rest of the cap along a weakened peripheral line, for example define by a series of perforations which weaken the material and provide a locus for failure when the cap is removed.

A problem with some caps of this type is that during installation, as the band is being forced over the bottle's retaining flange, the resistance force not only puts large axial compression forces on the weakened peripheral line: it also expands the band radially. The combination of these two factors gives rise to the possibility that the band will tend to ride up over (around) the bottom of the cap, failing the tamper-evident features-prematurely.

EP228618A2 discloses a tamper-indicating closure comprising means for preventing undue diametral expansion of the tamper-evident band. The tamper-evident band is provided with inwardly and upwardly directed protrusions on its upper edge. During relative axial movement between the tamper-evident band and the skirt of the closure, these projections engage the bottom edge of the skirt of the closure. The protrusions comprise an inclined upper and outer surface. When this surface engages the lower edge of the skirt, the tamper-evident band is prevented from unduly expanding. Such means, however, need a separate cutting operation for their fabrication and work only if there is a relative axial movement between the tamper-evident band and the skirt of the closure. This axial movement may lead to premature failure of frangible bridges connecting the tamper-evident band to the skirt.

SUMMARY OF THE INVENTION

An object of the invention is to reinforce a bottle cap having a tamper-evident band against axial compression failure as described above.

This and other objectives of the invention are achieved by the invention described below. According to this invention, a compression failure resistant tamper evident bottle cap is formed, including a skirt with a lower edge, and a tamper-evident band formed integrally with the skirt and having structure for engaging beneath a retaining flange on the bottle so as to prevent subsequent withdrawal of the band. Frangible bridges connect the band to the lower edge of the skirt. To prevent destruction of the bridges as the cap is forced onto the bottle during installation, the skirt has one or more tabs or the like, extending downward over a portion of the band, for preventing undue diametral expansion of the tamper-evident band as it passes over the retaining flange.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings,

FIG. **1** is a top plan view of a compression failure resistant tamper evident bottle cap embodying the invention;

FIG. **2** is a side elevation thereof;

FIG. **3** is a detail of a portion of FIG. **2**;

FIG. **4** is a sectional view taken on the plane **4—4** in FIG. **1**, with a portion of the bottle finish added;

FIG. **5** is a detail of a portion of FIG. **4**;

FIG. **6** is a similar detail, apart from the bottle finish;

FIG. **7** shows the bottle cap being installed onto a bottle;

FIG. **8** is a view like FIG. **2**, of a second embodiment of the invention,

FIG. **9** is a view like FIG. **2**, of a third embodiment of the invention;

FIG. **10** is a view like FIG. **4**, of a fourth embodiment of the invention; and

FIG. **11** is a view like FIG. **10**, showing the cap partially removed from the bottle.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A compression failure resistant tamper evident bottle cap embodying the invention is shown in FIGS. **1–7**. The cap has a number of conventional features, including a planar, circular base **12** surrounded by a circular skirt **14** having a helical internal thread **16** for engaging a complementary thread **16** (see FIG. **7**) on a bottle neck **18**. The circular rib **20** on the bottom of the base provides a seal within the bottle mouth **22** when the cap is in place.

FIGS. **4** and **5** show the tamper-evident band **24** which is connected to the bottom of the skirt by a series of frangible bridges **26** designed to fail when the cap is removed from the bottle. However, the bridges must not fail when the cap is installed on the bottle at the factory, or they will give a false indication of tampering.

In FIG. **5**, one can see the cap being installed on a bottle, the internal circumferential frusto-conical sleeve **28** being pushed outward as its free edge passes over the external flange **30** on the bottle neck. The bottom of the flange has a **20** steep pressure angle, greater than the angle of repose for the two materials in combination, so that the band remains captured as the cap is removed, by a retention force greater than that needed to break the bridges.

One can see, in FIG. **5**, that the tamper evident band is expanded diametrally during installation, so that the bridges gain an oblique orientation. At the same time, the band experiences axial resistance to being forced over the bottle flange. These two factors combine to encourage continued flexure of the bridges, which in extreme cases can result in the band tending to ride up over (outside) the skirt, breaking the bridges.

Now, according to this invention, the amount of bridge flexure during installation is limited by providing, on the bottom edge of the skirt, structure which limits outward expansion of the band, and brings the skirt to bear directly down on the band, so that the bridges are not unduly stressed.

This protective structure may take a number of forms. The one presently most preferred is that shown in the first seven figures. In this embodiment, the skirt has a series of tabs **32** which extend downwardly, radially containing the uppermost part of the band. The windows **34** between the tabs are

centered over the bridges, permitting one to see the bridges, and also facilitating manufacture. One can clearly see the function of the tabs in FIGS. **5** and **7**, where they are preventing undue outward movement of the band during **10** installation. At all other times, the tabs are out of contact with the band, the only connection then being the bridges.

FIG. **8** shows a modified form of the invention, which is the same in all respects as that previously described, except the there are no windows: the tabs are replaced by a continuous circular rim **36** which performs the same function as the tabs, perhaps with some added strength, but with the disadvantage that the bridges are hidden from view.

In the embodiment of FIG. **9**, the tabs have been replaced by much narrower, more numerous lugs **38** which again keep the band from expanding too much during installation.

In FIGS. **10** and **11**, the expansion-limiting structure **40** is, as in FIG. **8**, continuous, but axially abbreviated, so that one can still see the bridges. The internal lip **42** depicted provides a sealing function not important to the present invention.

In each embodiment of the invention, the expansion-limited structure at the bottom of the cap's skirt prevents the band from riding up over the cap during installation, and thus maintains the integrity of the bridges.

It may be noted that the bridges can be replaced by functional equivalents. For example, a circumferentially continuous thin connector strip, or a score line, might connect the band to the skirt. The bridges might be fairly narrow, circumferentially, as shown in FIG. **3**, or they might have substantially width. Conceivably, they could be defined between a series of perforations in the cap material. Other variations may occur to people in this field.

Since the invention is subject to modifications and variations, it is intended that the foregoing description and the accompanying drawings shall be interpreted as only illustrative of the invention defined by the following claims.

We claim:

1. A compression failure resistant tamper evident bottle cap for installation on a bottle having a retaining flange, said cap comprising,

a skirt having a lower edge;

a tamper evident band having an outer surface an upper edge and a lower edge, and formed integrally with the skirt and having means for engaging beneath the retaining flange so as to prevent removal of the band from the bottle;

frangible means for connecting the band to the lower edge of the skirt, said frangible means being a series of bridges molded at circumferential intervals between the skirt and the band; and

means for preventing undue diametrical expansion of the tamper evident band as the cap is being installed on the bottle;

said expansion preventing means comprising a plurality of tabs extending downwardly from the lower edge of the skirt to a point above the lower edge of the tamper-evident band, and a plurality of windows between the tabs, said windows being centered over the bridges so that all the bridges are visible between the tabs,

such that the tabs substantially contact the outer surface of the upper edge of the tamper evident band during installation of said cap on said bottle, thereby providing restraining engagement of the tamper evident band to protect the structural integrity of the frangible means.

* * * * *

US005871111A

United States Patent [19]

Pfefferkorn et al.

[11] Patent Number: 5,871,111

[45] Date of Patent: *Feb. 16, 1999

[54] **SCREWABLE CLOSURE CAP WITH SECURITY AGAINST OVER-TIGHTENING**

[75] Inventors: **Georg Pfefferkorn; Michael Kirchgessner**, both of Egringen, Germany

[73] Assignee: **Crown Cork AG**, Reinach, Switzerland

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **530,237**

[22] PCT Filed: **Jan. 26, 1995**

[86] PCT No.: **PCT/CH95/00017**

§ 371 Date: **May 15, 1996**

§ 102(e) Date: **May 15, 1996**

[87] PCT Pub. No.: **WO95/21095**

PCT Pub. Date: **Aug. 10, 1995**

[30] **Foreign Application Priority Data**

Feb. 1, 1994 [CH] Switzerland 289/94

[51] **Int. Cl.**[6] **B65D 41/04**; B65D 51/16

[52] **U.S. Cl.** **215/307**; 215/329; 215/331; 215/341; 215/344; 215/345; 215/354; 215/902

[58] **Field of Search** ..... 215/330, 331, 215/270, 271, 307, 339, 338, 343, 329, 344, 345, 341, 354, 321, DIG. 1, 902, 311, 313, 314, 316; 220/231, 288, 303, 366.1, 360

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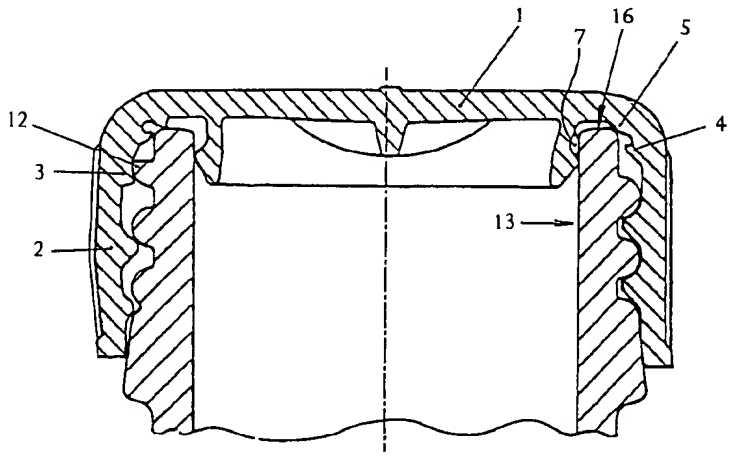
Primary Examiner—Stephen J. Castellano
Assistant Examiner—Niki M. Eloshway
Attorney, Agent, or Firm—Woodcock Washburn Kurtz Mackiewicz & Norris LLP

[57] **ABSTRACT**

In the case of over-tightening of the closure-cap on a beverage bottle (through turning in the wrong direction) there is the risk that, due to the high internal pressure, not only will the thread jump, but also that the cap will be ejected directly from the container. In order to avoid this risk, the invention proposes a screwable closure-cap with security against over-tightening. This cap possesses a ramp element (3) on the end of the thread oriented towards the cap-base, said ramp element being able to engage with the thread-start of the container mouth in the case of over-tightening of the closure-cap. As a result, the cap-wall in the area of the ramp element will be forced outwards in the case of over-tightening so that jumping of the thread in this region will be facilitated. In this way, jumping of the thread on one side only—on the ramp element side—will be achieved when over-tightening is continued, so that ejection of the closure-cap will not be possible. In a further embodiment of the invention, retention elements (7,8) are arranged in the region of the seal. As a result of over-tightening and subsequent deformation of the region of the seal, said retention elements will make contact with the container mouth and the sealing-line will be interrupted. As a result, the container will be vented prior to jumping of the thread.

13 Claims, 4 Drawing Sheets



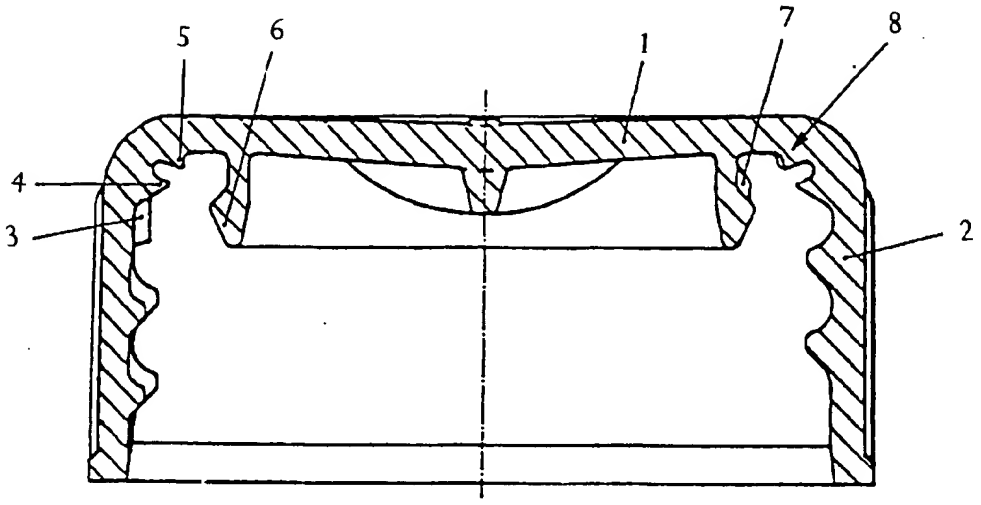


FIG. 1

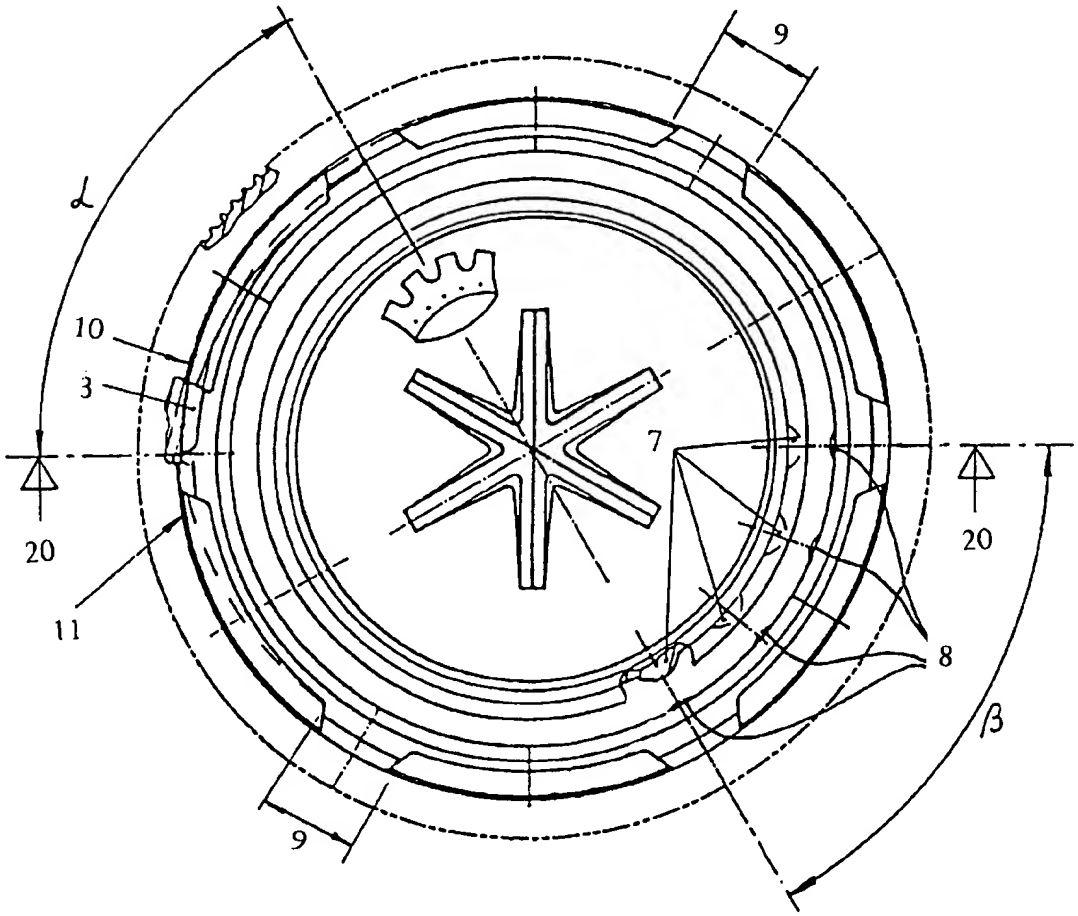


FIG. 2

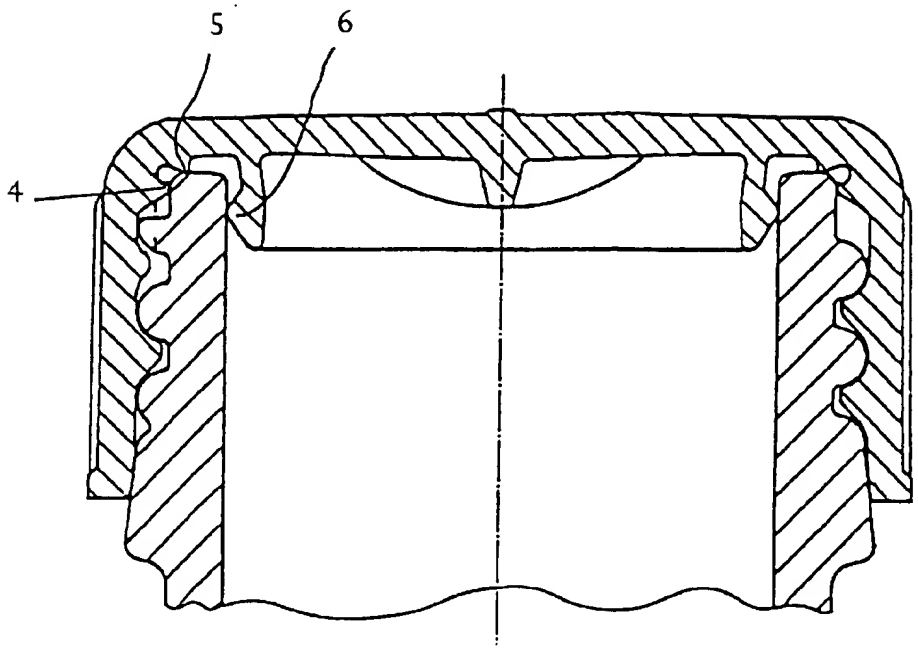


FIG. 3

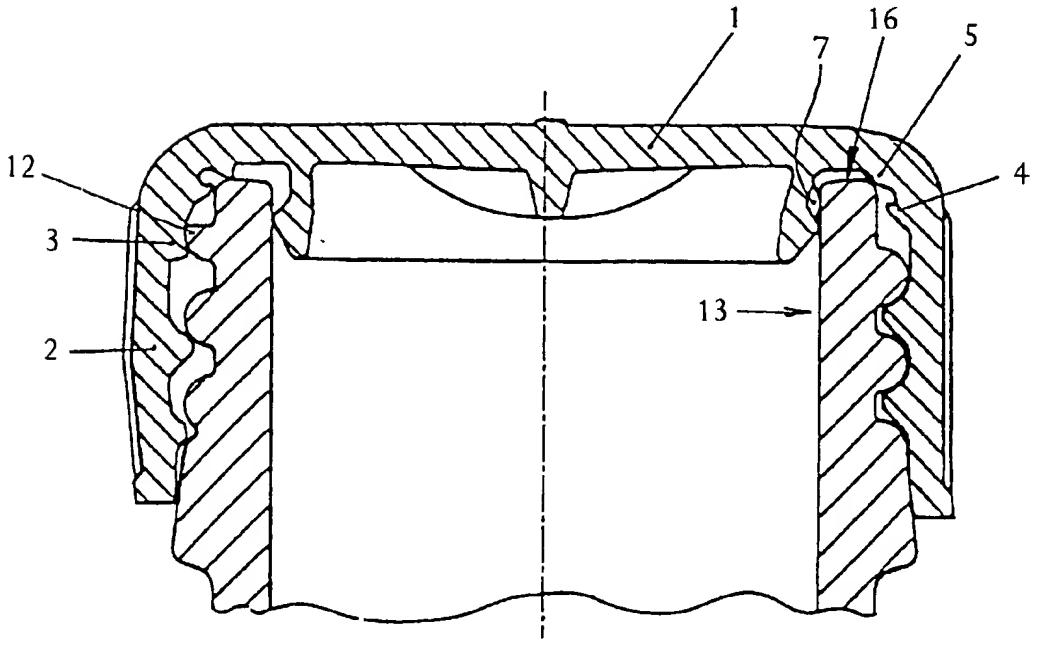


FIG. 4

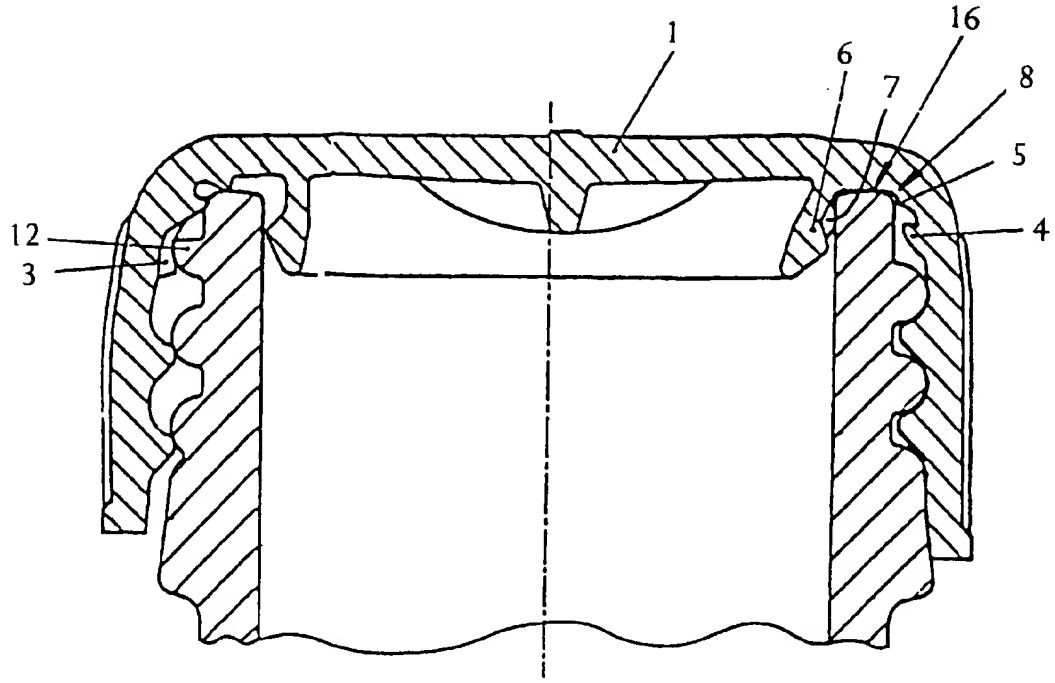


FIG. 5

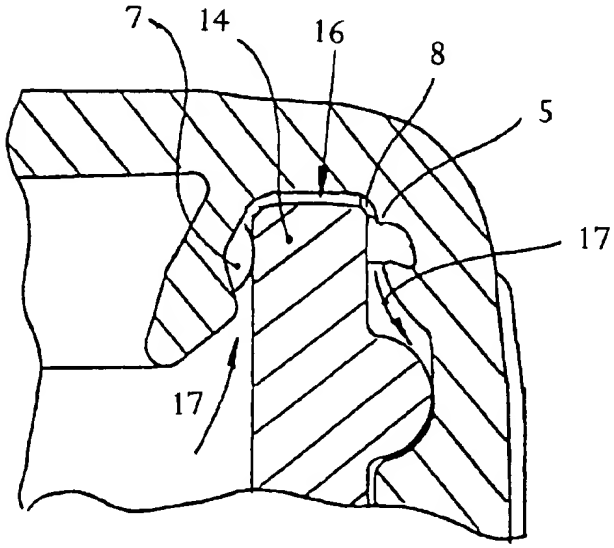


FIG. 6

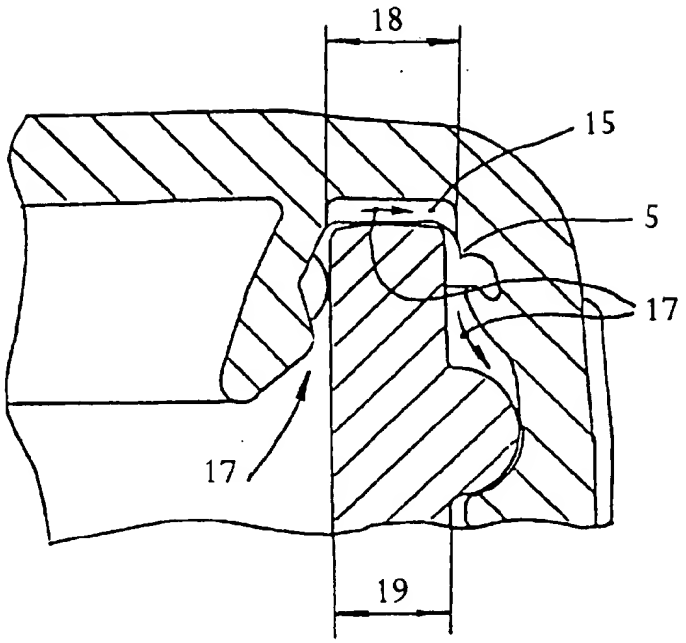


FIG. 7

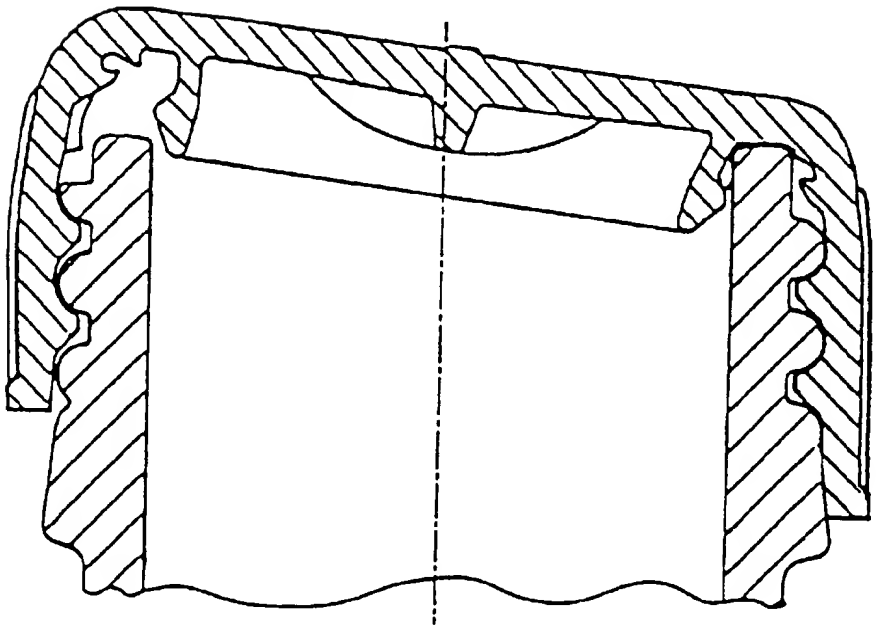


FIG. 8

SCREWABLE CLOSURE CAP WITH SECURITY AGAINST OVER-TIGHTENING

The invention concerns a plastic screw-cap according to the preamble of the independent patent claims. These types of screw-caps are manufacture by the injection molding process in very great quantities, and are used as closures for containers of the most varying types. Plastic screw-caps have become established mainly in the area of refreshment beverages containing carbon dioxide. The closed container can be subjected to extreme pressure in these cases, since the liquid it contains has been treated with carbon dioxide and will release gas.

Closure-caps are already known which are constructed in such a way that, on opening the closure, the container will be vented prior to the closure-cap thread being disengaged from the container. The risk of the closure suddenly being ejected from the container due to the high pressure will thus be lessened.

A problem with known screw-caps is their behaviour in the case of mishandling. If, in order to open it, the closure is accidently rotated in the wrong direction, over-tightening of the thread will result, and with continued over-tightening the closure thread can jump. This behaviour would be inconsequential with non-pressurised containers. After jumping, the closure-cap would re-engage on the container one thread-winding further up. If the container is under pressure, however, which will be the case with beverages containing carbon dioxide, for example, it is possible that the thread will no longer re-engage sufficiently rapidly after jumping, and that the cap will fly at high speed away from the container. In the past, such behaviour during mishandling of the closure has led to accidents.

WO-90/10581 shows a closure-cap possessing a braking element. This element is arranged at the end of inside thread oriented towards the cap-base in such a way that it lies at least partly in the region of the outside thread helix. On completion of the screwing-on procedure, the braking element will therefore run up on the container mouth thread-start, and will remain engaged with this thread-start when the closure-cap is its fully screwed-on position. The brake element fulfils the function of braking the screwing-on motion when the required end-position has been reached. In the case of closure-caps lacking a braking element, this function is assumed by the seals.

It is a purpose of the invention to form the screw-caps of the type mentioned in the introduction in such a way that the risk of sudden ejection of the closure-cap as a result of over-tightening the thread is greatly reduced. According to the invention, this purpose is fulfilled with a screw-cap which possesses the features described in claim 1 or in claim 3.

A ramp element is located on the end of the inside thread oriented towards the cap-base. With that, the ramp element must not lie in the area of the thread-turns, but can be located outside of the thread area, in line with the threadend. The ramp element lies outside that area of the thread which is used when the screw-cap is in the screwed on position. It is arranged in such a way that it can be brought into engagement with the container mouth thread-start as a result of over-tightening of the closure-cap. The term "brought into engagement" means that the ramp element runs up onto the container mouth thread-start. The ramp element is thus located at least partly in line with the anticipated continuation of the helix for the outside thread, so that in the case of over-tightening of the closure-cap, it will come into the region of the thread-start, and will run up on said thread-start.

The risk of the cap being suddenly ejected by over-tightening is clearly lessened by this ramp element. The cap-wall in the region of this ramp element will be forced outwards due to the ramp element running up on the thread-start. This will result in thread jumping being facilitated on this side since, due to the cap-wall being pressed outwards, it will no longer be fully engaged. Exactly the opposite will occur on the side of the closure-cap opposite to the ramp segment: since the cap-wall is pressed outwards on the ramp element side, at this opposite point it will be pressed against the container neck with a corresponding increase in force, and jumping of the thread will thus be hindered. With continued over-tightening, jumping of the thread can indeed not be prevented, although a simultaneous jumping of the thread around the entire circumference will be prevented. Thread-jumping will occur first of all on the ramp element side, and only subsequently, if at all, on the opposing side. After jumping, re-engagement of the thread on the ramp element side will thus be achieved before the thread jumps in a similar way on the opposing side. The risk of complete ejection of the cap during over-tightening of the closure will as a result be greatly reduced.

In the case of over-tightening, the ramp element will cause a deformation of the closure-cap. This deformation can be additionally exploited in order to enable venting of the container prior to jumping of the thread. The closure-cap possesses at least one surrounding seal. This seal lies along a sealing-line at the mouth of the container. The course of the sealing-line is able to be altered by the ramp element during over-tightening of the closure-cap, with the alteration to the course of the sealing-line being a result of the deformation caused by the ramp element. The security of the closure-cap against over-tightening will be further improved if, in the region of the seal, at least one retention element is provided in the region of the seal in order to prevent a seal being formed when the course of the sealing-line has been altered. The ramp element thus indirectly prevents sealing of the container when the closure-cap is over-tightened. As over-tightening increases, the subsequent deformation will likewise increase. In order to reduce the pressure within the container at the correct moment, the deformation necessary for opening the seal must be achieved prior to jumping of the thread.

The actual design of the ramp element exerts an influence on the force applied to cause over-tightening as well as the associated deformation of the closure-cap. A form is preferred where the ramp element extends over a sector of at least 20°, preferably 60° of the closure-cap. The intended deformation will be then attained if the inside radius in the region of the ramp element is only a few tenths of a millimeter less than the outside radius of the container thread.

By increasing the thickness of the ramp element, the attainable deformation can be increased. This thickness is limited by the diameter of the container mouth to be closed; the inside radius in the region of the ramp element must be greater than the outside radius of the container mouth.

In order to fully exploit the container thread, the closure-cap is so designed that, with the closure-cap in the screwed on position, the inside thread-end comes to lie in the region of the outside thread-start. The ramp element is then preferably arranged directly behind the inside thread-end.

The sealing-line is a line along which the closure-cap and container mouth make contact. In order to prevent the formation of a seal, it must be ensured that no further surrounding sealing-line exists. The alteration to the course of the sealing-line can occur in two ways: in the first

instance, on the basis of the cap deformation, a sealing-lip can be caused to lift away in a certain region of the container mouth. The second instance is much more frequently encountered, with which the sealing-line is displaced. With that, the point of contact displaces away from the sealing-lip to a region which lies adjacent to the sealing-lip. This new point of contact is now, on the basis of at least one retention element, designed in such a way that the formation of a seal at this point is prevented. Here, basically any type of surface profile can be involved which is suitable to prevent the formation of a seal between the point of contact concerned and the container mouth. Frequently, a retention element is allocated to a specific sealing-lip and arranged in such a way that this sealing-line is interrupted as rapidly as possible in the case of over-tightening. In each case, the retention element will be located within the region of the seal of the closure-cap, i.e. near the seals which are generally arranged on the cap-base and/or in the adjacent region of the cap-wall.

Distance elements and/or venting-slots are preferably used as retention elements. Distance elements mostly take the form of a cam and tend to possess a small contact surface so that a venting-channel of sufficient size will remain open adjacent to the sealing element.

The deformation caused by the ramp element is not limited to the cap-wall, but also effects the cap-base. This will undergo displacement towards the side of the closure-cap oriented away from the ramp element=a most surprising behaviour. Because the cap-wall is pressed outwards on the ramp element side, a displacement of the cap-base would also be expected in this direction. The reason for this behaviour, however, lies in the differential engagement of the thread on each side. The cap-wall will be pressed outwards by the ramp element in this region, and the thread will no longer fully engage at this point. On the opposing side, the opposite is the case: the cap-wall will be forced against the container neck and the thread will be tightly engaged. On the side of the ramp element, the cap-wall will hence displace upwards, and will tend to jump over. Conversely, on the opposing side it will be forced downwards by the tightly engaged thread, by which means the cap-base will also be forced to this side. On the side of the closure-cap opposite the ramp element, a particularly marked alteration to the course of the sealing-line will ensue, so that the retention element is preferably arranged on this side.

A type of seal which is preferably used here is described as a head-seal: a seal which takes effect on the facing surface. This seal extends over the inside surface of the cap-base and, when the container is closed, will lie against the facing surface of the container mouth. The seal must be designed in such a way that the sealing-line is able to be interrupted due to the deformation occurring in the case of over-tightening. In addition, it is easiest if the marked deformation in the region of the seal on the side opposite the ramp element is exploited. The seal is thus designed in such a way that, in the case of over-tightening, the sealing-lip in this region is dragged out over the facing surface of the container mouth. At least one retention element is arranged on the side of the closure-cap opposite the ramp element, adjacent to and on the inner side of the head-seal. As soon as the sealing-lip disengages from the container mouth in the case of over-tightening, said sealing-lip will come to rest against the closure-cap in the region of the retention element, which will prevent formation of a seal for the container. Both a distance element and a venting-slot can be used as a retention element. In order to maintain as large a venting-channel as possible, it must be ensured that the sealing-lip dragged out across the face of the container does not lie on the outer surface of the container mouth. This can be achieved in an especially simple way by using a distance element which is so arranged that the contact force impinging upon it is at least partially radial, taking effect in an outwards direction. The sealing-lip will thus be forced away from the container mouth.

Another frequently used type of seal is the internal-seal. This extends from the inside surface of the cap-base towards the cap-opening and is designed in such a way that, with a closed container, it protrudes into the container opening and can form a seal on its inner surface. In addition, the internal-seal possesses a sealing-zone in which the diameter of the internal-seal is greater than the diameter of the container opening. Also with this example, in the case of over-tightening, displacement of the cap-base occurring as a result of the ramp element will be exploited, in order to interrupt the sealing-line. In principle, this can ensue both on the ramp element side and on the opposing side of the closure-cap. As has already been described, in the case of over-tightening, the cap-base will be forced to the side of the closure-cap oriented away from the ramp element. On the ramp element side, the internal-seal will at the same time be forced away from the inside surface of the container mouth. With sufficient displacement of the cap-base, the seal in this area will be lifted away, and this will lead to an interruption of the sealing-line. In this case, no retention element will be necessary for interruption of the sealing-line. Since the seal is under tension against the container mouth, this will only ensue with marked deformation of the closure-cap.

A more rapid opening if the internal-seal can be achieved on the opposing side of the closure-cap. For this purpose, the outside surface of the internal-seal possesses at least one retention element on the side oriented away from the ramp element, said retention element being arranged on the side of the sealing-zone oriented towards the cap-base. With that, the radius of the internal-seal in the region of the retention element is only slightly smaller than in the region of the sealing-zone, so that the said retention element does not make contact with the container mouth when the closurecap is in place. Through displacement of the cap-base in the case of over-tightening of the closure-cap, the seal in this region will be forced more tightly against the inside wall of the container mouth. Since the seal makes contact with the container mouth in the region of the sealing-zone, it will maintain its position at this point. Conversely, it will not make contact with the container mouth in the region of the cap-base, and this region of the seal will thus be displaced with the cap-base in the direction of the container wall. This restriction of displacement to the cap-base will inevitably lead to an inclination of the internal-seal. With that, the retention element will move closer to the inside surface of the mouth. With sufficient distortion, the internal-seal will make contact with the container mouth in the region of the retention element, and the sealing-zone will thus be lifted away from the container mouth. A knob shaped distance element is preferably used as a retention element in this case. The seal can thus be designed to be considerable thinner, only approximately attaining the radius of the sealing-zone in the region of the distance element. In this way, the necessary freedom of movement will be maintained, also for the inclined position of the seal.

As a rule, with known closure-caps numerous sealing-lips are employed in combination. For example, an internal-seal, a head-seal and an external-seal can be used. Accordingly, a combination of the described embodiments can be employed. The principles described can also be transferred to embodiments of seals which are not portrayed here.

The reliability of the security against over-tightening can be further improved if a plurality of retention elements are arranged to be distributed over a sector of at least 20°. Preferably, the retention elements are arranged to be distributed over a sector of approximately 60° of the closure-cap.

Distribution of the retention elements over a larger sector permits opening of a larger venting channel in the case of over-tightening. Venting of the container will thus be accelerated.

The invention is more closely explained on the basis of the following examples:

FIG. **1** a cross section through a closure-cap according to the plane **20—20** in FIG. **2**,

FIG. **2** a view of the inner side of a closure-cap,

FIG. **3** a sectional drawing of a container mouth with a closure-cap screwed in place,

FIG. **4** a sectional drawing of the container mouth according to FIG. **3**, with a closure-cap which has been over-tightened through 45°,

FIG. **5** a sectional drawing of the container mouth according to FIG. **3**, with a closure-cap which has been over-tightened through 90°,

FIG. **6** an enlarged drawing of the sealing region of the arrangement according to FIG. **5**, on the side opposite the ramp element,

FIG. **7** the sealing region, on the side opposite the ramp-element, of a closure-cap which has been over-tightened through 90°, and

FIG. **8** an arrangement according to FIG. **5** after jumping of the closure-cap.

FIG. **1** shows a sectional drawing of a closure-cap along the plane **20—20** shown in FIG. **2**. The cap comprises a cap-base **1** and a cap-wall **2** ajoining it. In order to seal the container mouth, the cap possesses three seals: an external-seal **4**, a head-seal **5** taking effect on the facing surface, and an internal-seal **6**. A ramp element is arranged on the inside surface of the cap-wall on the side of the internal thread which is oriented towards the cap-base. Distance elements **7**, **8** are arranged in the region of the seal on the side of the closure-cap opposite the ramp element, said distance elements serving as retention elements.

FIG. **2** shows the view of the inside of a closure-cap. The ramp element has the form of an annular sector which extends over a sector α of 60° of the closure-cap. This ramp element is arranged directly beyond the thread-end **11** and toward the cap-base in the direction of the internal thread path. When the closure-cap is in the screwed on position, the container thread-start will be engaged with the thread-end **11**. It will thus be positioned immediately in front of the ramp element **3**. If the closure-cap is subjected to over-tightening, the ramp element will come into engagement with the container mouth thread-start. A plurality of distance elements **7**, **8** are arranged on the side opposite the ramp element, distributed over a sector β of 60° of the closure-cap. The inside thread possesses a plurality of venting-slots **9** running approximately parallel to the axis of the cap. These venting-slots enable an easy flow of gas during venting of the container when the seal is opened.

FIG. **3** shows a cross-sectional drawing of a container mouth with the cap in the mounted position. The three sealing-lips **4**, **5**, **6** lie circumferentially against and hermetically seal the container mouth.

FIG. **4** shows a cross section of the container mouth according to FIG. **3**, with a closure-cap which has been over-tightened through 45°. The ramp element **3** has, with that, run up onto the thread-start **12** of the container mouth. The cap-wall **2** is thus pressed away from the outside surface of the container mouth in the region of the ramp element **3**, so that the inside thread is at this point less tightly engaged with the container thread. Jumping of the thread is therefore facilitated in the region of the ramp element. On the opposite side of the closure-cap, oriented away from the ramp element, the cap-wall will be pulled with correspondingly greater force against the container wall. The inside thread will thus be tightly engaged with the outside thread of the container. By means of the screw effect of the thread, in the event of over-tightening the cap-wall will be pulled downwards onto the container with a greater force in this region of the closure-cap. A deformation of the seal region will be the result, taking effect particularly on the side oriented towards the ramp element. With that, the external-seal **4** will be lifted away from the outer surface of the container mouth, and the sealing-line of the head-seal **5** will be displaced to the outer edge of the facing surface **16** of the container mouth. The cap-base **1** will also be displaced to the side oriented away from the ramp element, and this will lead to an inclination of the internal-seal on this side. At the same time, the distance elements **7** will be brought into a position nearer to the inside surface of the container mouth **13**.

FIG. **5** shows a cross-sectional drawing of the container mouth according to FIG. **3**, with a closure-cap which has been subjected to over-tightening through 90°. In comparison with FIG. **4**, which shows the same closure arrangement but only subjected to 45° over-tightening, a clearly more extreme distortion of the seal region, in particular on the side opposite the ramp element, can be detected. The sealing-lip of the head-seal **5** has been dragged out over the outer edge of the facing surface of the container mouth. It does not make contact with the container in this region. Instead, the distance elements **8** now lie against the outer edge of the facing surface of the container mouth, and thus effectively prevent a seal from forming in this region of the container mouth. The cap-base, when compared with the condition shown in FIG. **4**, has been displaced further towards the side oriented away from the ramp element. The inclination of the internal seal has been increased as a result, so that the distance element **7** now rests against the container mouth inner surface. The actual sealing-zone of the internal-seal **6** will thus be pressed away from the inner surface of the container mouth in the region of the distance elements **7**. The sealing-line of the internal-seal is thus interrupted, and the distance elements **7** will prevent a seal being formed in the region of the internal-seal. In principle, for venting of the container it will then be sufficient to ensure that no surrounding sealing-line exists. The embodiment shown in this example has a special advantage in that all sealing-lines in the same circumferential region, namely on the side opposite the ramp element, will be interrupted. As result, a particularly direct venting-channel will arise.

FIG. **6** shows an enlarged drawing of the sealing region of the arrangement according to FIG. **5**, on the side opposite the ramp element. The closure-cap only makes contact with the container mouth **14** in the region of the distance elements **7**, **8**. The gas within the container can therefore escape as suggested by the arrows **17**. The distance element **8** takes effect both axially and radially and thus prevents both the formation of a seal in the region of the facing surface **16** of the container mouth and the formation of a seal against the outside surface of the container mouth by the displaced sealing-lip of the head-seal **5**.

FIG. **7** shows the region of the seal on the side opposite to the ramp element, in the case of a closure-cap which has been subjected to over-tightening through 90°. This venting-slot is commences adjacent to the sealing-lip of the head-

seal 5. Its length 18 is, at least when the region of the seal is subjected to deformation, greater than the thickness 19 of the wall the container mouth, so that it prevents the formation of a seal in the area of the facing surface of the container mouth.

FIG. 8 shows an arrangement according to FIG. 5 after jumping of the closure-cap 5. This will occur in the case of over-tightening through an angle of approximately 90°. With that, the thread will jump on one side, namely on the ramp element side, while remaining firmly engaged on the opposite side. This tendency can also be seen in FIGS. 4 and 5. In this way, with raised internal pressure in the container, re-engagement of the inside thread after thread-jumping can be achieved, with the closure-cap subsequently remaining on the container. In fact, no increased internal pressure will prevail at the moment of thread jumping, since this will have already been previously vented in accordance with the embodiments relating to FIGS. 5 to 7.

Inasmuch as the invention is subject to modifications and variations, the foregoing description and accompanying drawings should not be regarded as limiting the invention, which is defined by the following claims and various combinations thereof:

We claim:

1. Screwable, plastic closure-cap with a cap-base and an adjoining, cylindrical cap-wall, said cap-wall comprising an inside thread with a thread end directed toward the cap base for closure of a container mouth, said container mouth possessing an outside thread with a thread start;

said cap-wall further comprising sealing means to sealingly engage and form a seal line with the container mouth,

said cap-wall further comprising a ramp element which is arranged on the end of the inside thread oriented towards the cap-base and outside the area of the thread in use when the closure-cap is in the screwed-on position,

such that, in the case of over-tightening of the closure-cap, the ramp element is brought into engagement with the thread-start of the container mouth, forcing the cap wall outwardly and altering the seal line, thereby causing a deformation of the closure-cap and disengaging the sealing means from the container mouth in order to enable venting of the container.

2. The closure cap according to claim 1, characterized in and that in the region of the seal line at least one retention element is provided for prevention of the formation of a seal in the case of an altered course of the seal-line.

3. The closure cap according to claim 2, characterized in that said at least one retention element is arranged on a side of the closure-cap opposite the ramp element.

4. The closure cap according to claim 2, characterized in that said at least one retention element is a distance element for displacing a portion of the closure-cap away from the container mouth.

5. The closure cap according to claim 2, characterized in that at least one retention element is a venting-slot.

6. The closure cap according to claim 2, wherein said sealing means comprises a head-seal extending from the inside surface of the cap-base in order to seal the container mouth on its facing surface, and wherein on the side of the closure-cap opposite the ramp element at least one retention element is arranged next to and on the inner side of said head-seal.

7. The closure cap according to claim 2, said seal means comprising an internal seal extending from the inner surface of the cap base, and possessing at least one retention element on its outside surface circumferentially spaced approximately 180° away from the ramp element.

8. The closure cap according to claim 2, wherein said at least one retention element comprises a plurality of retention elements, said plurality of retention elements arranged to be distributed over a sector (β) of at least 20° of the closure cap.

9. The closure cap according to claim 8, characterized in that the retention elements are arranged to be distributed over a sector (β) of approximately 60° of the closure-cap.

10. The closure cap according to claim 1, characterized in that the ramp element extends over a sector (α) of at least 20° of the closure-cap.

11. The closure cap according to claim 1, characterized in that the ramp element is arranged directly beyond the thread-end.

12. The closure cap according to claim 1, characterized in that the closure cap has a vertically extending axis and the inside thread possesses venting-slots running approximately parallel to the axis of the cap.

13. A screwable, plastic closure-cap with a cap-base and an adjoining, cylindrical cap-wall, said cap-wall comprising an inside thread with a thread end directed toward the cap base for closure of a container mouth, said container mouth possessing an outside thread with a thread start;

said cap-wall further comprising sealing means to sealingly engage and form a seal line with the container mouth,

said cap-wall further comprising a ramp element which is arranged on the end of the inside thread oriented towards the cap-base and outside the area of the thread in use when the closure-cap is in the screwed-on position,

said cap-wall further comprising at least one retention element that is arranged on a side of the closure cap opposite to the ramp element,

such that, in the case of over-tightening of the closure-cap, the ramp element is brought into engagement with the thread-start of the container mouth and the retention element is brought nearer to an inside surface of the container mouth, forcing the cap wall outwardly and altering the seal line, thereby causing a deformation of the closure-cap and disengaging the sealing means from the container mouth in order to enable venting of the container.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,871,111

DATED : February 16, 1999

INVENTOR(S) : Pfefferkorn, et al

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the title page, item [30], delete "289/94" and insert --289/94-8--therefor.

delete "9206634 U" and insert --9206634-8 U-- therefor.

delete "9208944 U" and insert -- 9208944-5 U-- therefor.

Column 1, Line 6, delete "are manufacture by" and insert --are manufactured by-- therefor.

Column 1, Line 40, delete "is its fully" and insert --is at its fully-- therefor.

Column 1, Line 55, delete "threadend." and insert --thread-end.-- therefor.

Column 3, Line 27, delete "ramp element=a most" and insert --ramp element-a most-- therefor.

Column 4, Line 30, delete "A more rapid opening if the" and insert --A more rapid opening of the-- therefor.

Column 4, Line 38, delete "closurecap" and insert --closure-cap-- therefor.

Column 4, Line 56, delete "considerable thinner," and insert -- considerably thinner, -- therefor.

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INVENTOR(S) :Pfefferkorn, et al

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 6, Line 67, delete "slot is commences" and insert --slot 15 commences-- therefor.

Column 7, Line 47, delete "formation of a seal" and insert --formation of a seal line-- therefor.

Signed and Sealed this

Seventeenth Day of August, 1999

Attest:

Q. TODD DICKINSON

Attesting Officer

Acting Commissioner of Patents and Trademarks

US005803286A

United States Patent [19]

Pfefferkorn et al.

[11] Patent Number: 5,803,286

[45] Date of Patent: Sep. 8, 1998

[54] **PLASTIC CLOSURE CAP WITH EARLY VENTING INNER SEAL**

[75] Inventors: **George Pfefferkorn; Michael Kirchgessner**, both of Egringen, Germany

[73] Assignee: **Crown Cork AG**, Rainach, Switzerland

[21] Appl. No.: **725,057**

[22] Filed: **Oct. 2, 1996**

Related U.S. Application Data

[63] Continuation of Ser. No. 363,383, Dec. 23, 1994, abandoned.

[30] **Foreign Application Priority Data**

Dec. 23, 1993 [CH] Switzerland 3873/93

[51] **Int. Cl.**[6] **B65D 51/16**

[52] **U.S. Cl.** **215/307**; 215/344; 215/DIG. 1; 215/354

[58] **Field of Search** ..... 215/307, 341, 215/343, 344, 354, DIG. 1; 220/303, 307, 360, 366.1, 367.1, 796, 231

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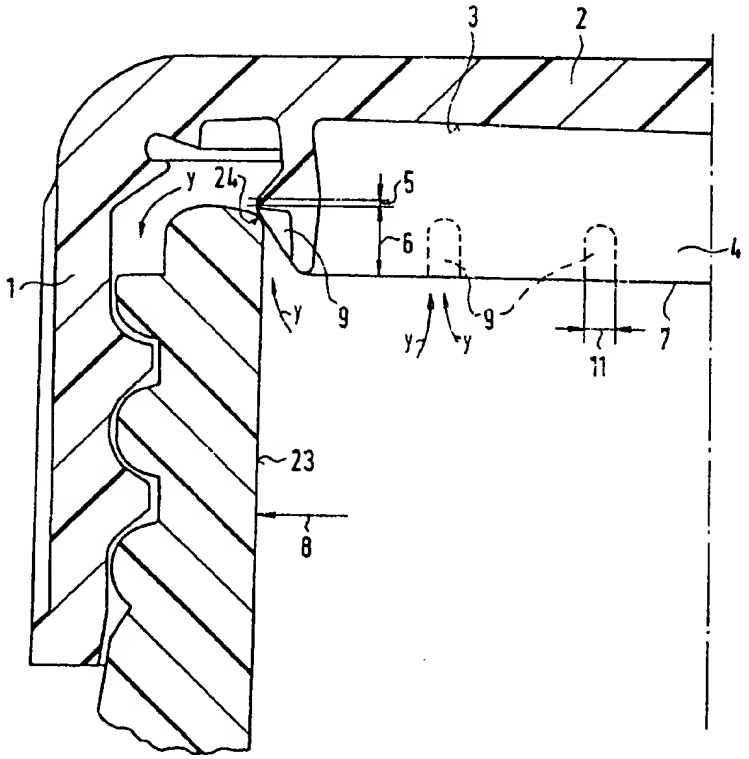
Primary Examiner—Allan N. Shoap
Assistant Examiner—Robin A. Hylton
Attorney, Agent, or Firm—Woodcock Washburn Kurtz Mackiewicz & Norris LLP

[57] **ABSTRACT**

The invention concerns a plastic screwable closure cap which possesses a bung type internal seal (4) for sealing a closeable container. The internal seal comprises a narrow sealing portion with an insert portion (6) immediately beneath, said insert portion serving to centre and gently introduce the internal seal. In order to attain the earliest possible venting of the closure cap when screwing off, venting recesses are provided on the insert zone (6). These prevent the insert portion from sealing the container, and enable the release of gas from the container as soon as the sealing portion comes out of engagement with the container mouth. The side surfaces of the vent recesses also serves as friction surfaces, in order to generally flatten irregularities on the container mouth before the actual sealing portion is engaged.

11 Claims, 4 Drawing Sheets



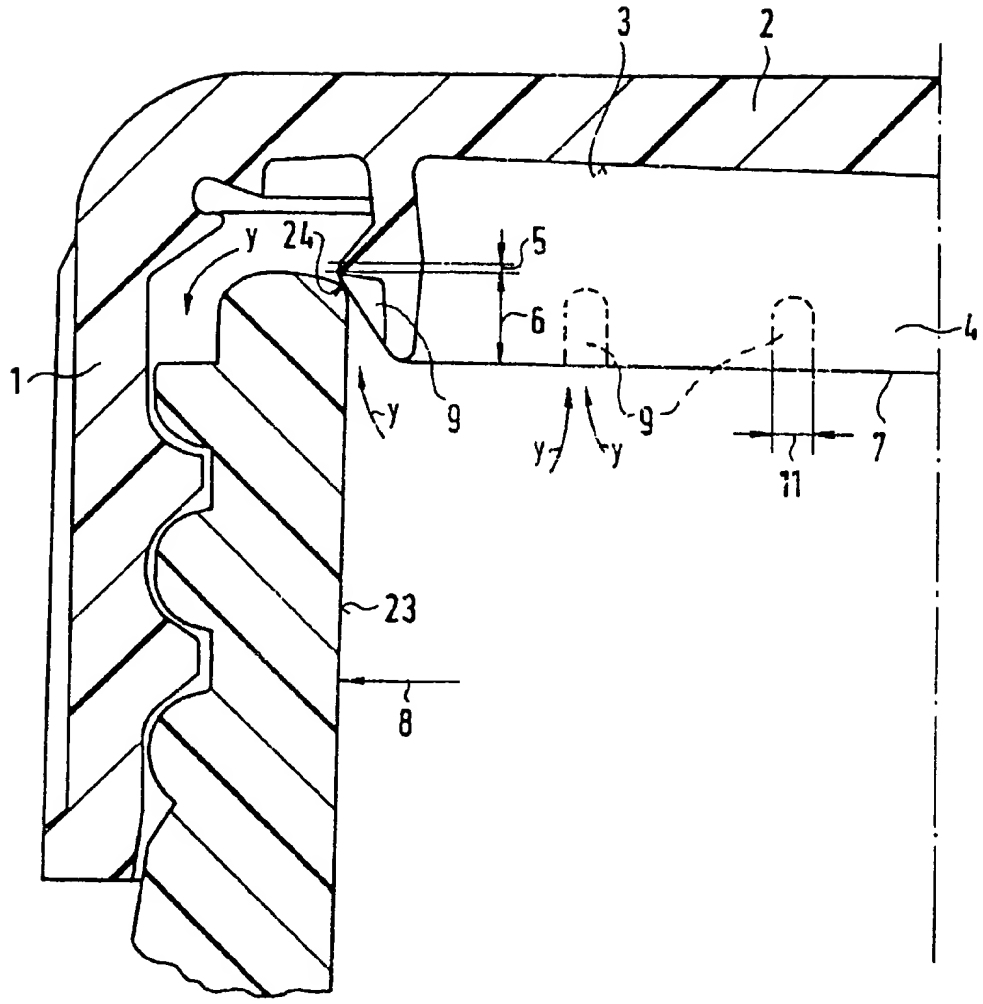


FIG.1

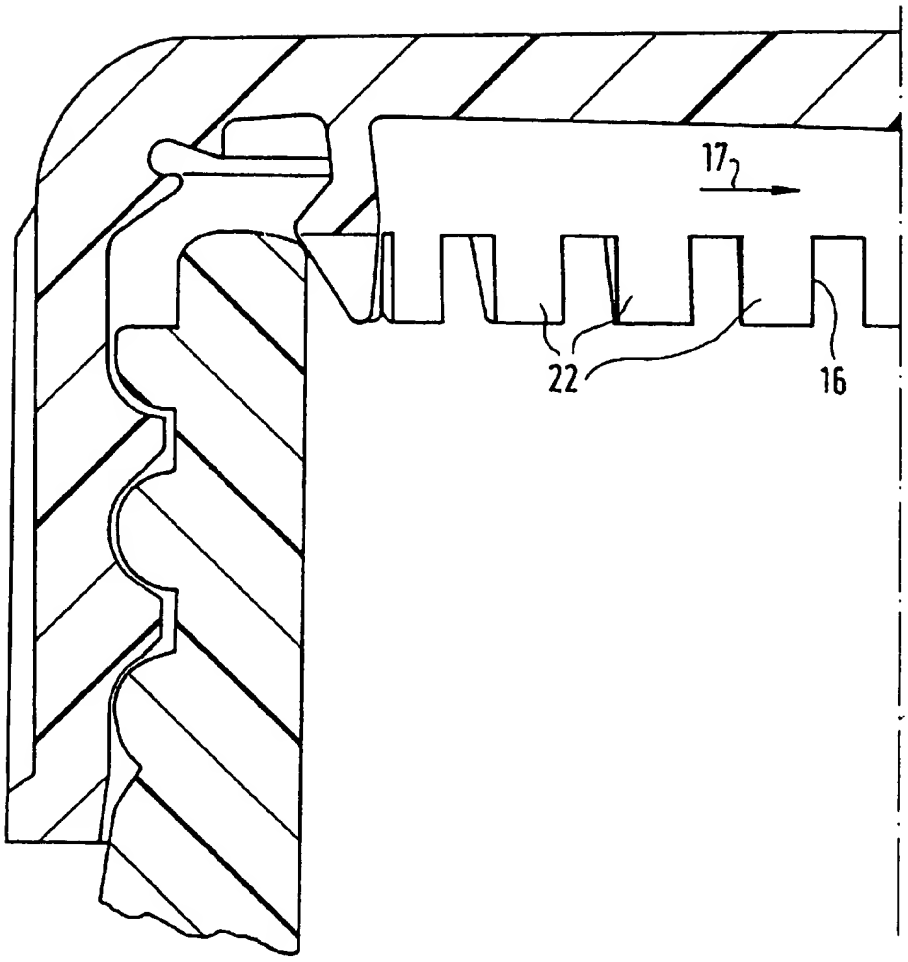


FIG. 2

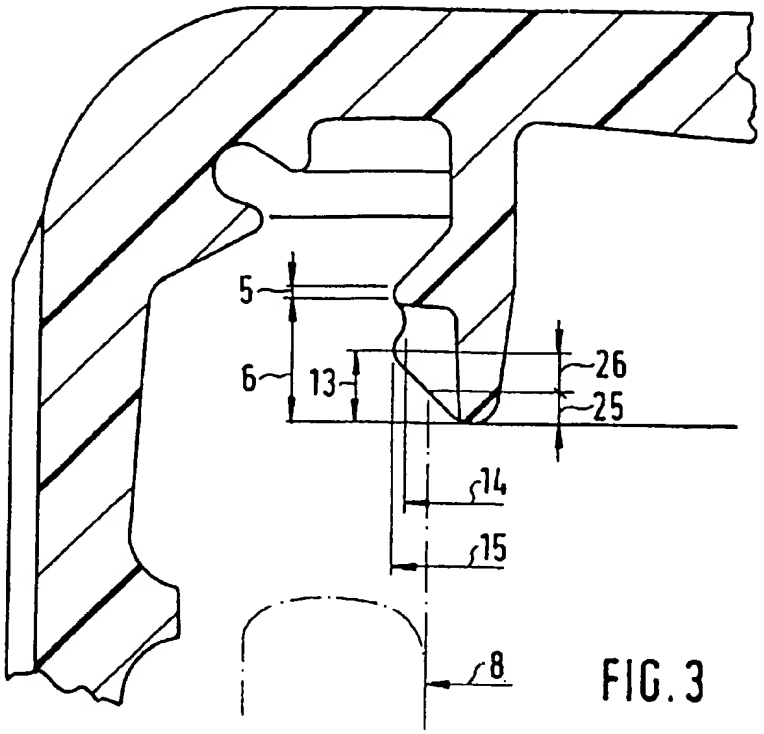


FIG. 3

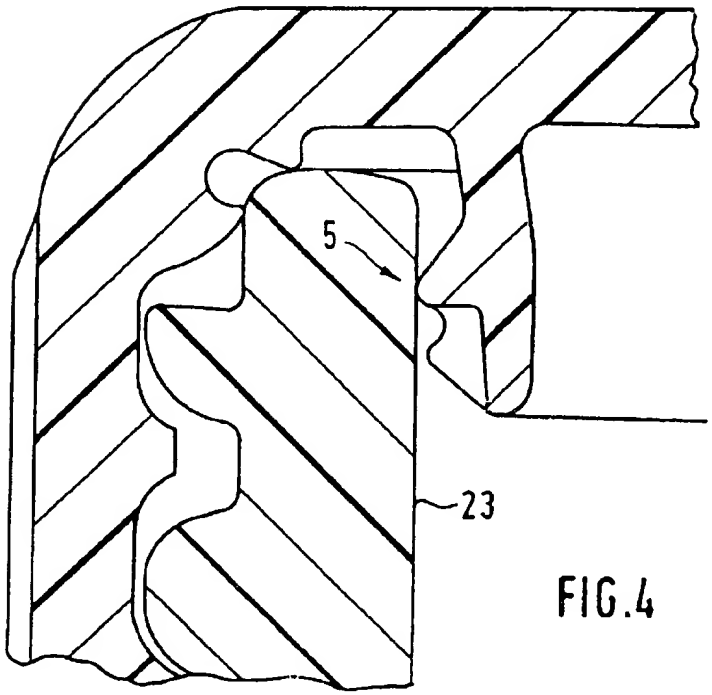


FIG. 4

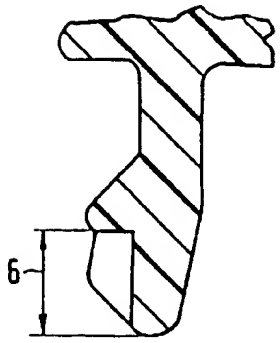


FIG. 5

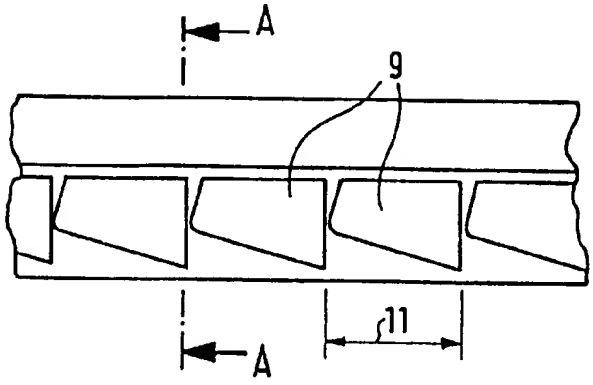
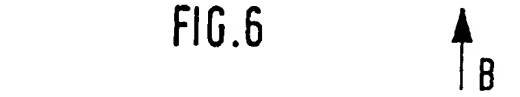


FIG. 6



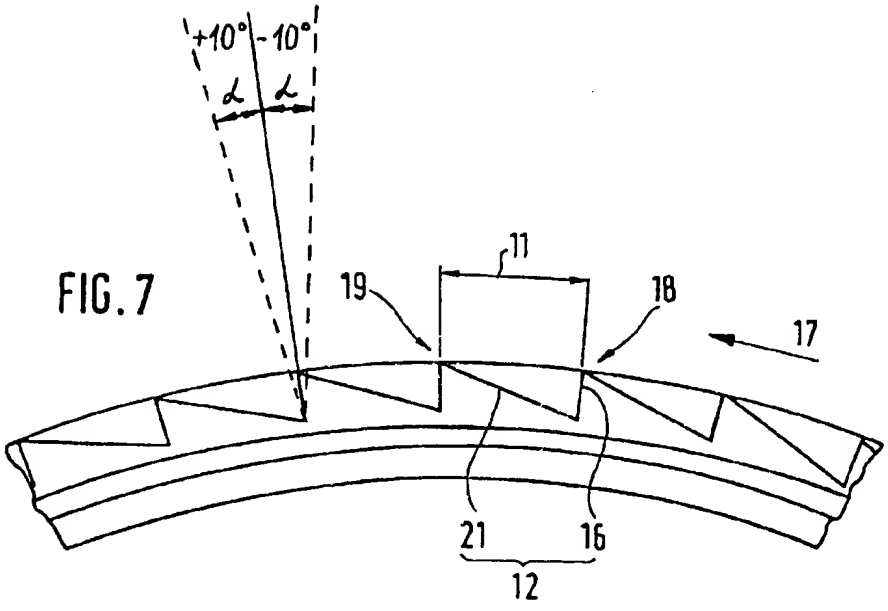


FIG. 7

PLASTIC CLOSURE CAP WITH EARLY VENTING INNER SEAL

This is a continuation of application Ser. No. 08/363,383, filed Dec. 23, 1993, now abandoned.

BACKGROUND OF THE INVENTION

The invention concerns a screwable closure cap of a plastic material according to the preamble to claim 1. The term "screwable" is in this respect to be understood in such a way that not only closure caps with screw threads but also bayonnet closures are implied. These types of closure caps have been known and in use for a long time, are mainly used for closing bottles for refreshment beverages containing carbon dioxide. In the cases of bottles, these are frequently re-useable bottles made of glass or PET. Since the container mouth, in particular in the case of re-useable bottles, is frequently damaged, seals which protrude into the container mouth are frequently used for sealing of the container. In this way, the main sealing portion is displaced slightly into the interior of the bottle mouth. An optimal sealing effect is ensured in this way, also when the area of the mouth is damaged. EP-118 267 shows such a closure cap.

In the case of refreshment beverages containing carbon dioxide, high internal pressure exists within the closed container. A problem with these types of closure caps is that internal pressure can only be reduced when the internal seal is fully removed from the container mouth. Internal seals of the said type possess a surrounding sealing portion, whose outer diameter is somewhat larger than the inner diameter of the bottle mouth. It is thus ensured that the sealing portion, when the closure cap is attached, is pressed against the inner wall of the bottle mouth. An insert portion is located beneath the sealing portion, the outer diameter of which is slightly conically reduced in the downward direction, so that the diameter of the lower end of the seal is smaller than the diameter of the bottle mouth. This is necessary in order to ensure damage-free insertion of the internal seal when screwing on the screw cap. This configuration for the internal seal enables the upper area of the insert portion to still tightly seal the container if the actual sealing portion has already assumed a position outside the container mouth. This in turn leads to an unnecessarily late reduction of pressure when the closure cap is being screwed off. Although, in principle, this disadvantage could be dealt with by shortening the insert portion, a certain length for the insert portion is necessary, in order to introduce the inner seal both reliably and protectively.

The known seals have a further disadvantage, in that the outside surface of the insert portion, which makes the initial contact with the container mouth, possesses a smooth outer surface. As a result, the insert portion is hardly capable of levelling the rough, irregular or damaged points on the bottle mouth, with the additional risk that the sealing portion, which is essentially responsible for sealing, can be subjected to damage.

SUMMARY OF THE INVENTION

It is therefore a purpose of the invention to avoid the known disadvantages, and in particular to create a closure cap of the type mentioned in the introduction, with which the internal pressure is reliably reduced while screwing off the closure cap, as soon as the sealing portion of the internal seal has taken up a position outside the container mouth. At the same time, insertion of the internal seal into the container mouth should in no way be detrimentally affected. A further purpose of the invention is to design the insert portion in such a way that surface irregularities of the container mouth are flattened when screwing on the closure cap, so that the sealing portion is not, at the same time, subjected to damage.

According to the invention, the purpose of the invention is fulfilled by a closure cap possessing the features of claim 1. The internal seal possesses a sealing portion, and an insert portion beneath said sealing portion. The sealing portion is that part of the internal seal which makes contact with the inner side of container mouth when the closure cap is attached, thus forming a seal. The primary purpose of the insert portion is to reliably and gently introduce the internal seal into the container mouth. From the functional point of view, the insert portion can be further subdivided: the most forwardly placed section is the centering zone, in which the outer diameter is less than the diameter of the container mouth. This zone centers and guides the internal seal during attachment of the closure cap. Following the centering zone is a compression zone, in which the outer diameter is larger than the diameter of the container mouth. During introduction of the compression zone into the container orifice, the internal seal is compressed, and thus placed under tension. In the area of the insert portion, the outer surface of the internal seal possesses at least one vent recess. This vent recess forms a connecting channel to the interior space of the container as soon as the sealing portion becomes disengaged from the container mouth. It prevents the insert portion from being able to form a seal with the container mouth, and thus ensures that venting of the container occurs at the earliest possible moment. It is thus ensured that the internal thread of the closure cap remains securely engaged with the outside thread of the container neck until commencement of venting. In the case of excessive internal pressure and delayed venting of the container, the risk of sudden ejection of the closure cap while screwing off said closure is this avoided.

The vent recess is preferably designed in such a way that it extends at least over the entire height of the compression zone. It will thus be ensured that an open vent channel exists as soon as the sealing portion is out of engagement with the container mouth.

The number of vent recesses, as well as their width and depth, impart an influence on the rate of venting when opening the container. It must be noted that the insert zone does not fulfill its function in the area of the vent recess. In order to prevent destruction of the sealing portion in the area of the vent recess, it is beneficial to ensure that the width of the vent recess does not exceed 1/15 of the circumference of the inner seal.

Independent from the vent recesses, the diameter of the insert portion is to be understood as the diameter of the outermost surface. If a plurality of vent recesses are directly adjacent to each other, then the outer surface of the insert zone can be reduced to a series of individual edges. Thus, the term "uninterrupted surface" will occasionally be used, by which a theoretical outer surface without vent recesses is implied. The internal seal is frequently so designed that its outer diameter in the area of the insert portion reduces towards its lower end. The outer diameter, as a rule tapering and reducing continuously in the downward direction, results in uniform compression of the internal seal whilst being screwed on, until the sealing portion has entered the container mouth. During this compression phase, the insert portion makes contact with the inner edge of the container mouth. The friction occurring through rotation of the closure has in this case a flattening effect on any irregularities in the area of the mouth. Such a frictional effect can be aimed at by suitable design of the vent recesses.

01/24/2003, EAST Version: 1.03.0002

In the case of another, likewise beneficial, design of the insert portion, said insert portion merely possesses a slipping zone in its lower area, within which the outer diameter reduces towards the lower end. Between the slipping zone and the sealing portion, the outer diameter of the internal seal possesses a local minimum value in the form of a groove, so that at the upper end of the said slipping zone a local maximum value will ensue, said maximum value being greater than the diameter of the container mouth to be closed. This is beneficially selected to be as large as possible, indeed in such a way that, with the closure cap placed on the container mouth, the cutting edge will be lifted from the inner wall of the container as soon as the sealing portion is introduced into the container mouth. This configuration has the advantage that the insert portion, when screwing on the closure cap, will make contact with the inner surface of the mouth as soon as the slipping portion has entered the container mouth. Thus, the frictional effect of the insert portion will also be effective in the area of the mouth inner surface.

The shape of the vent itself can also strongly influence the frictional effect of the insert portion. The frictional effect will be beneficially enhanced if, between the vent recesses, cutting edges are provided, for flattening irregularities or damaged edges on the mouths of plastic containers. In describing the design of these recesses, standard terms from milling and cutting processes will be used to define the cutting geometry. With that, the vent recesses should be compared with the gap between two saw teeth. Although the closure cap comprises relatively soft plastic, the best results are attained with an effective cutting angle of approximately 0°. The surface of the vent recess, on its forward end seen in the direction of screwing on, forms the face which meets the uninterrupted surface of the insert portion approximately at right angles along a cutting edge. The cutting edge is thus so aligned that it can operate as a blade during rotation of the closure cap in the direction of screwing on. Optimal results can be obtained with an effective cutting angle in the region of ±10°. No actual material removing process can be attained with the aid of this primitive plastic cutter, even with plastic containers. That is also not intended, since plastic chippings would otherwise fall into the beverage. In practice, a type of plastic deformation of burrs and notches is concerned, which would actually suggest a negative effective cutting angle. Due to the soft cutting material, the best results were nevertheless obtained with effective cutting angles of approximately 0°.

Since the insert portion comes into engagement while screwing on the closure cap for only a fraction of a rotation, a single vent recess is not sufficient for processing the entire circumference of the mouth in the way described above. The closure cap can be further improved, therefore, by uniformly arranging a plurality of vent recesses around the diameter of the internal seal. Particularly satisfactory frictional properties are attained if the vent recesses are arranged at the same distance from each other, in particular if a plurality of vent recesses are arranged directly adjacent to each other, so that the outer surface of the internal seal will be restricted to that area where the vent openings make contact on single edges. When screwing on the closure cap, the contact surface in the insert zone is thus restricted to individual edges, and this results in high surface pressure, which in turn has a positive effect on the friction and levelling effect.

In the case of directly adjacent vent recesses, the best results are obtained using the already mentioned cutting geometry with an effective cutting angle of 0°. In order to nevertheless ensure stability of the individual "saw teeth", the surface of the vent recess is, on its opposite side, on the rear end as seen in the direction of screwing on, designed in such a way that, at a shallow angle, it meets the "uninterrupted surface", as already defined, of the internal seal as a heel. Good results were obtained with a heel angle of less than 30°.

As an alternative to the saw tooth shaped design, symmetrical vent recesses can also be used. A cutting geometry with a negative effective cutting angle and a positive heel angle will thus arise, which both possess the same value. Similar frictional values are thus attained for screwing on and off. Good results are achieved if the effective cutting angles and heel angles are each less than 60°.

A high frictional value, without limiting the centering and guide functions of the insert portion, were achieved with internal seals which possess at least 25 and at most 50 vent recesses, distributed around the circumference.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more closely described in the following, with the aid of examples of different embodiments, namely:

FIG. **1** A cross section of a container mouth with a closure cap which is screwed off until venting is initiated,

FIG. **2** a cross section of a container mouth with a closure cap with, in places, interrupted insert portion,

FIG. **3** a cross section of the sealing area of a closure cap,

FIG. **4** a cross section of a sealing portion of a closure cap in the screwed on position,

FIG. **5** a cross section through the plane A—A according to FIG. **6**,

FIG. **6** a detail of the side view of an internal seal with a plurality of adjacent vent recesses arranged like saw teeth,

FIG. **7** a detail of the internal seal shown in FIG. **6** (direction B according to FIG. **6**)

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** shows a cross section of a container mouth with a closure cap which has been screwed off until venting is initiated. The closure cap comprises a cylindrical cap wall **1** and an adjacent cap base **2**. An internal seal **4** extends, coaxially with the cap wall **1**, from the internal surface **3** towards the cap opening. If the closure cap is completely screwed onto the container neck, then a limited area of the outer surface of the internal seal will make contact with the inner surface **23** of the container mouth. This area is classified as the sealing portion **5**. Its outer diameter is greater than the diameter **8** of the container mouth. The insert portion **6** is beneath the sealing portion. The outside diameter of said insert portion reduces conically downwards. When screwing on the closure cap, the outside surface of the insert portion **6** is the first to come into contact with the container mouth, with the sealing portion **5** only reaching the container mouth later. The diameter of the insert portion, which reduces downwards, rests against the inner edge **24** of the container mouth. It centres the internal seal on the container mouth and ensures that this is gently tensioned before the seal portion **5** reaches the container mouth. When screwing off the closure cap, the reverse procedure will apply. First of all, the sealing portion is retracted from the container mouth, although the internal seal initially remains under tension because the insert portion is still in contact the container mouth. The internal seal can only once again expand if, with further unscrewing, the insert portion is

extracted from the container mouth. During unscrewing, the insert portion remains in contact with the container mouth until the internal seal has expanded into its normal position. The insert portion is consequently divided into two areas: the lower area of the insert portion serves to centre the internal seal on the container mouth, and the compression zone commences at the point where the outside diameter of the insert portion reaches the diameter **8** of the container mouth.

In the area of the insert portion, the internal seal possesses a plurality of vent recesses. These prevent the internal seal, during screwing off of the closure cap, from forming a sealing action in the area of the compression zone. In order to ensure venting of the container at the earliest possible moment, the vent recesses **9** commence directly beneath the sealing portion. With the closure cap shown here, the sealing portion is located just outside of the container mouth. Gas from the container can flow through the vent recesses **9**, in the direction of the arrow Y.

In order to place the internal seal under uniform tension by means of the insert portion, care must be taken that the width 11 of the vent recesses is not selected to be too large. If the slipping surface of the insert zone is interrupted by very wide vent recesses, there will be a risk that the internal seal, in the area of these recesses, will locally be pressed outwards during screwing on. This can lead to damage to the seal portion during attachment of the closure cap. Good results have been achieved with vent recesses, the width of which are not in excess of 1/15 of the seal circumference.

FIG. **2** shows a cross section of a container mouth with a closure cap with an insert portion which is, in places, interrupted. The vent recesses used in this case are slots which divide the insert zone into individual guide lugs **22**. These continuous slots cause very rapid venting of the container as soon as the sealing portion is disengaged from the container mouth. The closure cap has a right-hand thread, so that the portion **16** located on the front edge of the recess surface, seen in the direction **17** of screwing on, acts as a face and forms a cutting edge with the outside surface of the internal seal. Although, because of the heel angle of 0°, the expression "cutting" cannot be used in an actual sense with the insert lugs **22**, the terminology face and cutting edge will nevertheless be applied here.

FIG. **3** shows the sealing area of a closure cap according to the invention. The internal seal possesses a local maximum **15** in the area of the insert portion **6**. The centering and compressing function of the insert portion is assumed by slipping zone **13** located beneath the said maximum diameter. The slipping zone itself is functionally divided into a centering zone **25** in which the outer diameter is less than the diameter **8** of the container mouth, and a compression zone **26** in which the outer diameter is greater than the diameter **8** of the container mouth. The container mouth to be closed has been suggested by a dotted line. Between the local maximium **15** and the sealing portion **5**, the internal seal possesses a groove shaped depression so that the outer diameter here reduces to a local minimum **14**. Thus, the levelling frictional effect of the insert zone is beneficially further extended into the inner surface of the container mouth. The friction takes effect on the inner edge of the container mouth, until the slipping zone **13** has been fully inserted into the container mouth. During further rotation to close the closure cap, that point with the local maximum diameter is forced into the container mouth and the frictional effect is then displaced onto the inner surface of the container mouth. By this means, also surface irregularities on the inner side of the mouth will be levelled by the insert portion. The compression of the internal seal is not increased in this case. The compression of the internal seal is only slightly raised again if, after further screwing on, the sealing portion **5** extends further into the container mouth, whereupon the main force of the tensioned internal seal is imparted onto the sealing portion. The maximum diameter of the insert portion is beneficially selected in such a way that said insert portion is completely relieved as soon as the sealing portion has been introduced into the container mouth.

FIG. **4** shows a cross section of the sealing area of a closure cap in the screwed on position. The closure is in the fully screwed on position and the internal seal is in contact with the inner surface of the mouth **23** of the container, solely in the area of the sealing portion **5**.

FIG. **5** shows a cross section through the plane A—A according to FIG. **6**. An internal seal is concerned here, the outer diameter of which possesses a local maximum in the area of the insert portion **6**.

FIG. **6** shows a detail of the side view of an internal seal, the outer diameter of which, as can be seen in FIG. **5**, possesses a local maximum in the area of the insert portion. This cross-sectional configuration of the internal seal has already been explained in connection with FIGS. **3** and **4**.

The internal seal possesses, in the insert portion, a plurality of directly adjacent vent recesses **9** around the entire circumference. In this example, two adjacent vent recesses **9** make contact solely at one point, namely there, where the outer diameter of the insert portion is at its greatest. This point is at the same time the most essential for the frictional effect since, as explained in connection with FIG. **3**, a frictional effect is also imparted onto the inner side of the mouth by this point. By means of the recesses being immediately adjacent to each other, the insert portion attains a form which possesses the character of a cutting tool.

FIG. **7** shows the internal seal as shown in FIG. **6** from below (direction B according to FIG. **6**). The cutter shaped indentation through the vent recesses can be seen in this representation. On the front side of the vent recesses, seen in the direction of rotation during screwing on, the face **16** forms an angle of approximately 90° with the uninterrupted surface of the internal seal, which is the equivalent of an effective cutting angle of 0°. A preferred region of ±10°, for selection of the effective cutting angle α, is shown by a dotted line in this figure. On the rear end of the recess, the heel **21** creates a somewhat shallow angle with the same uninterrupted surface. In this example, not only the heel **21** but also the face **16** is formed as a plane running parallel to the axis of the closure cap. As a result of the cross section selected for the seal, which can be seen in FIG. **5**, the individual recesses meet solely at one point. Further embodiments of the vent recesses are possible, for optimization of the desired frictional effect. These will be dependent on the assessment of the expert. In particular, the recesses can also be formed in such a way they make contact with each other not merely at one point, but along a cutting edge.

Inasmuch as the invention is subject to modifications and variations, the foregoing description and accompanying drawings should not be regarded as limiting the invention, which is defined by the following claims and various combinations thereof:

We claim:

1. A screwably plastic closure cap for sealing a container at its orifice, said closure cap comprising:

a cylindrical cap wall;

a cap base having an inner surface and being adjacent to said cylindrical cap wall;

an internal seal extending downwardly from the inner surface of said cap base, said internal seal possessing a radially outer surface comprising a surrounding sealing portion on its outer edge for internal sealing of the container orifice to be closed and possessing an insert portion beneath the sealing portion;

said sealing portion being spaced from the cap base and defining a maximum outer diameter of the internal seal prior to placement on the container;

said insert portion comprising a compression zone, whereby the compression zone is designed to engage the container orifice and be compressed when the insert portion is inserted into the orifice;

wherein the radially outer surface of the internal seal possesses, in the area of said insert portion, at least one vent recess, said vent recess extending at least over the entire height of the compression zone, said compression zone and said at least one vent recess being axially below said sealing portion.

2. A closure cap according to claim **1**, characterized in that the outer diameter of the internal seal, in the area of the insert portion (**6**), reduces towards the lower end (**7**) of said internal seal.

3. A closure cap according to claim **1**, characterized in that the width (**11**) of the vent recess does not exceed 1/15 of the circumference of the internal seal.

4. A closure cap according to claim **1**, characterized in that, on the front end (**18**) of the vent recess seen in the direction of screwing on (**17**), the surface of said vent recess meets the uninterrupted surface formed on the insert portion as a face (**16**), along an effective cutting edge (**18**) and approximately at a right angle.

5. A closure cap according to claim **1**, characterized in that a plurality of vent recesses (**9**) are arranged to be distributed around the circumference of the internal seal.

6. A closure cap according to claim **5**, characterized in that, between the vent recesses, cutting edges are provided to flatten irregular or damaged edges of the mouth of plastic containers.

7. A closure cap according to claim **6**, characterized in that the vent recesses are arranged at a uniform distance from one other.

8. A closure cap according to claim **7**, characterized in that the vent recesses (**9**) are immediately adjacent to one another.

9. A closure cap according to claim **8**, characterized in that, at the rear end (**19**) of the vent recess (**9**) seen in the direction of screwing on (**17**), the surface of the vent recess meets an uninterrupted surface of the insert portion at a shallow angle as a heel (**21**).

10. A closure cap according to claim **1**, characterized in that the internal seal possesses at least 25, and at the most 50, vent recesses (**9**).

11. A closure cap according to claim **1**, characterized in that the insert portion possesses a slipping zone in its lower most region, the diameter within that slipping zone reducing towards the lower end, and the outer diameter between the slipping zone and the sealing portion possessing a local minimum value so that the local maximum diameter will arise at the upper end of said slipping zone, said maximum diameter being designed to engage the container at the orifice when said closure cap is applied to the container.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,803,286
DATED : September 8, 1998
INVENTOR(S) : George Pfefferkorn; Michael Kirchgessner

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

Page 1, Column 1, Line 8, delete "Rainach" and insert - - Reinach- - therefor.

Page 1, Column 2, Line 4, insert " 4,712,699 12/87 Lutz 215/354 X

Column 1, Line 5, delete "Dec. 23, 1993," and insert - -Dec. 23, 1994- - therefor.

Column 1, Line 16, delete "In the cases of bottles," and insert - -In the case of bottles,- - therefor.

Column 2, Line 35, delete "is this avoided." and insert - -is thus avoided.- - therefor.

Column 4, Line 65, delete "is still in contact the" and insert - -is still in contact with the- - therefor.

Column 6, Line 63, delete "A screwably plastic" and insert - - A screwable plastic- - therefor.

Signed and Sealed this

Eighth Day of June, 1999

Attest:

Attesting Officer

Q. TODD DICKINSON

Acting Commissioner of Patents and Trademarks

US006021912A

United States Patent [19]

Hertrampf

[11] **Patent Number: 6,021,912**

[45] **Date of Patent: Feb. 8, 2000**

[54] **CLOSURE FOR A BOTTLE OR THE LIKE**

[75] Inventor: **Michael Hertrampf**, Gehrden, Germany

[73] Assignee: **Safety Cap Systems AG**, Ch-Biel-Benken, Switzerland

[21] Appl. No.: **09/051,710**

[22] PCT Filed: **Oct. 25, 1996**

[86] PCT No.: **PCT/EP96/04646**

§ 371 Date: **Apr. 17, 1998**

§ 102(e) Date: **Apr. 17, 1998**

[87] PCT Pub. No.: **WO97/16356**

PCT Pub. Date: **May 9, 1997**

[30] **Foreign Application Priority Data**

Oct. 31, 1995 [DE] Germany 195 40 560
Apr. 6, 1996 [DE] Germany 196 13 830

[51] **Int. Cl.**[7] **B65D 51/16**; B65D 53/02

[52] **U.S. Cl.** **215/344**; 215/260; 215/270; 215/345

[58] **Field of Search** 215/344, 260, 215/270, 271, 311, 307, 329, 341, 343, 354, 902, 345; 220/203.01, 203.09, 203.29, 303

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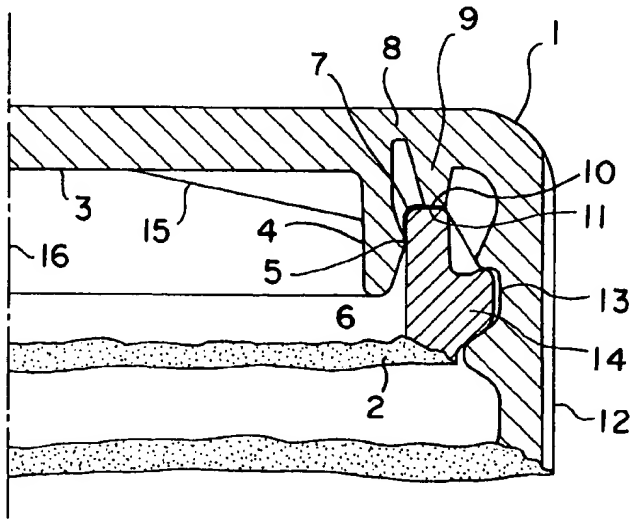
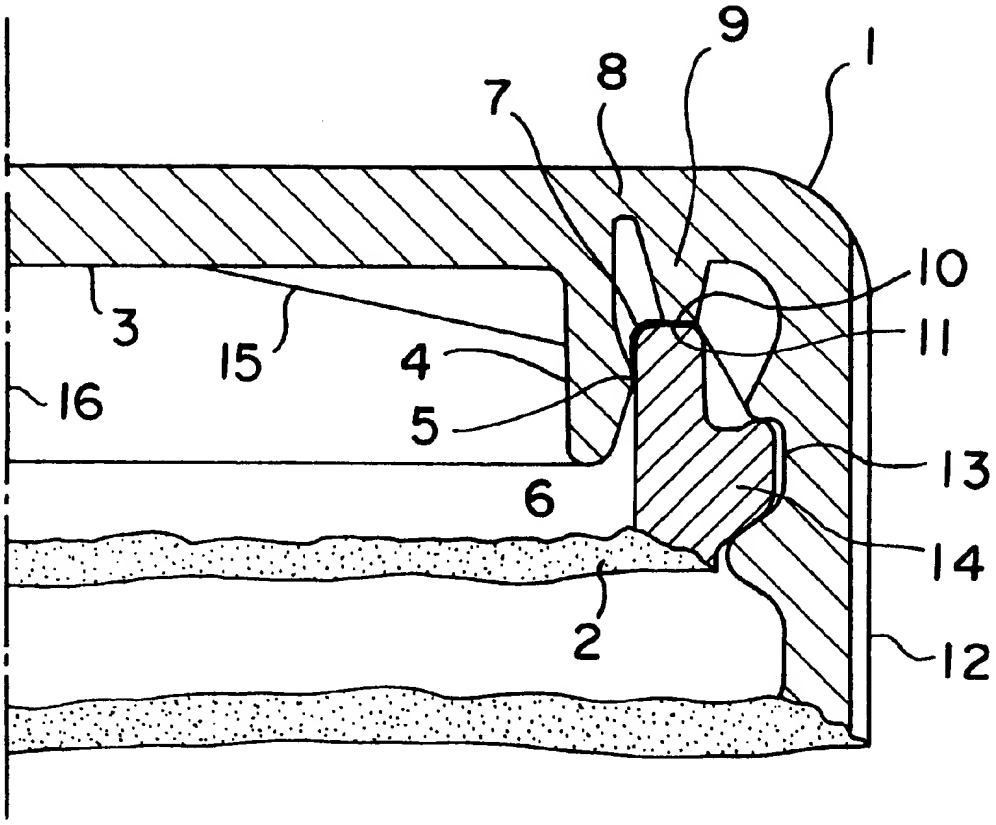
[57] **ABSTRACT**

A closure for a bottle, comprising a cap-shaped closure component; a projection directed inwardly from an edge of the cap-shaped closure component to grip behind an outwardly directed projection at a neck of a bottle; a substantially cylindrical sealing element extending axially from a bottom of the closure component, the sealing element being disposed within the closure component; and a radial projection formed outside of the sealing element and disposed away from the bottom and having a diameter larger than the inside diameter of the neck of the bottle to be sealed by the closure means in such a way that a sealing surface formed by the radial projection tightly rests against an inside surface of the neck in a closed mode. The bottom comprises a cross-sectional slimming disposed radially beyond the cylindrical sealing element, the slimming having a thickness less than the thickness of an adjacent portion of the bottom such that the slimming functions as a hinge. The bottom and the sealing element form an elbow lever pivotable about the hinge. At least one rib is disposed in a space formed between the bottom and the sealing element to brace the sealing element against movement relative to the bottom, such that upon bulging of the bottom the radial projection is substantially radially detached from the inside surface of the neck by a lever action of the elbow lever pivotable about the hinge.

7 Claims, 1 Drawing Sheet

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CLOSURE FOR A BOTTLE OR THE LIKE

FIELD OF THE INVENTION

The invention concerns a closure means for a bottle or the like.

BACKGROUND OF THE INVENTION

The British patent document 2,013,635 A discloses a closure means of this kind wherein the radial projection rests against the inside wall of the bottle neck in the immediate vicinity of its own orifice rim. The cylindrical sealing element is very short and the outside of the projection lies closely to the bottom of the cap-shaped closure component. The bottom bulges outwardly in case of overpressure. When deforming in this convex manner, the sealing projection follows said mainly axially directed bulging until, at a given overpressure and hence at a given bulge, it is released from in the inner mouth rim of the bottle's neck and in this manner subtends gap through which the overpressure may be relieved. In this manner the said sealing means forms an overpressure valve averting bottle bursting and entailed dangers.

This known closure means incurs a drawback in that in practice the front inner rim at the mouth of the bottle neck demands high precision of manufacture, so that no defined rest of the sealing projection is assured exactly in the critical range wherein the overpressure valve formed by the closure means shall open and close. In addition, as regards such bottles, and especially those glass bottles to be reused several times, the inner rim edge of the bottle neck is damaged and thus will not be sealing.

Another drawback of this known closure means is that on account of pressure changes arising in practice by heating and then cooling the contents of the bottle fitted with said closure means, the sealing projection steadily slides in the axial direction on the inside surface of the mouth of the bottle acting as a valve seat, whereby the sealing surface of the projection may be abraded or damaged and then be leaking.

Lastly the known closure means incurs the drawback that the necessity of axial displacement in turn requires axial yielding by the cap outside the cylindrical sealing element. This requirement is met in this known closure means embodied by a screw cap by shearing the bottom outside the cylindrical sealing element and by axially stretching the outer cylindrical part. However said stretching includes prestressing which in turn depends on the screw-on torque, in any event it depends during customer use on the particular torque applied by the user in screwing on the screw cap. Consequently the pressure at which for safety reasons there shall be pressure relief will not be provided with the desired reliability to preclude bottle bursting at excessive pressure.

The British patent document 958,417 discloses a closure means of a similar kind, also in the form of a screw cap fitted with projections inside its bottom and serving as stops and coming to rest against the rim edge of a bottle neck when said cap is being screwed onto it. In this design the stretching of the outer cap part comprising the thread is not utilized to impart axial displaceability to the bottom. The elasticity of this axial displaceability being determinant for the opening pressure, whereas only the region between the cylindrical sealing element and the outer rim of the top end of the bottle neck are available for yielding, the bottom must be made very thin to achieve adequately elastic yielding. This feature is a drawback, the more so that it entails very tight manufacturing tolerances.

The objective of the invention is to create a closure means of the kind defined in the preamble of claim 1 wherein inaccuracies of or damage to the front inner edge of the mouth of a bottle neck are not disadvantageous and where its sealing will not be degraded even in the presence of frequent pressure changes.

SUMMARY OF THE INVENTION

The basic concept of the disclosure of the invention is to implement the opening of the overpressure valve formed between the closure means and the neck of a bottle not by an axial displacement of the sealing projection along the sealing element, whereby the position and nature of the front inside edge of the mouth of a bottle neck assume predominant significance, instead by a radially inward displacement of the sealing projection. This radial displacement is implemented in that a cross-sectional slimming acting as a hinge is present in the bottom directly radially outside the cylindrical sealing element. Said slimming causes a peripheral zone of the closure component, as seen in the bottom's cross-section, to rotate about the hinge so formed when said bottom is made to bulge, whereas the outer region remains substantially unaffected. Because the cylindrical sealing part is solidly joined directly inside from the hinge to the bottom and because in this manner an elbow lever is formed between the bottom and the cylindrical sealing element, it follows that, upon bottom bulging, the sealing element pivots inward and as a result the sealing projection at its outer surface of said element is pressure-relieved and, upon sufficient pressure, will detach off the cylindrical inside surface of the bottle neck.

To ensure this radial pressure relief or this radial detachment under all circumstances, the radially sealing projection is so mounted in a special feature of the invention that for all bottom bulging caused by overpressure said projection shall be located in the region of the substantially cylindrical inside surface of the bottle neck.

The above discussion relates essentially to cross-sectional views, the cylindrical sealing element so viewed then actually forming a lever. In reality however a cylinder is involved, and therefore the cross-sectionally viewed lever effect in reality is a cross-sectional slimming of the cylindrical sealing element relative to the periphery. However pressure relief or detachment of the projection remain unaffected. Obviously the mechanical conditions also are affected by the length and rigidity of the cylindrical sealing element, however these are parameters which can be selected by a typical expert. The same consideration applies to the design of the hinge-forming cross-sectional slimming in the bottom of the cap-shaped closure means. The cross-sectional slimming must be pronounced enough in the axial direction to achieve the desired easy pivoting. On the other hand said slimming must be limited radially to avert undesired parallel motion in the axial direction.

In a development of the invention, the closure component comprises an axial stop located radially outside the cross-sectional slimming acting as a hinge to rest against an opposite mating stop at the bottle neck. Appropriately said stop is mounted in the radial region of the top end of a bottle neck forming the mating stop. Illustratively the stop may be formed merely by the conceptually extended bottom resting against the end surface of a bottle neck and thereby causing the closure means'bottom to be firmly positioned in the outer rim zone, thereby precluding axial motions of the hinge and hence axial motions of the sealing surface formed at the projection of the sealing element and hence also

friction between the sealing surface and the cylindrical inner surface of the bottle neck. In this manner abrasion of and damage to this sealing surface caused by bulge changes of the closure-means bottom due to pressure variations cannot arise.

The axial stop at the closure component obviously must be designed to allow the overpressure to escape through this stop. If the stop is annular, this escape may be assured using radial channels or passages. However the stop may be in the form of discrete stop elements distributed along the periphery of the sealing element and thereby forming passages between them. Moreover the stop may be designed to rest against a projection outside the bottle neck, said projection then forming the mating stop.

In a further embodiment of the invention, a rib is present between the sealing cap and the cylindrical closure means, said rib bracing the elbow lever formed by the bottom and the closure component. As a result the motion of the bottom caused by bulging due to increasing pressure in a closed bottle is more effectively transmitted to the cylindrical sealing element and hence pressure relief, or lifting of the projection, is improved, especially regarding the inside pressure acting radially outward on the sealing element.

In the simplest cases, the advantageous rib effect can be achieved with only one rib. Obviously several peripherally equidistant ribs also may be used.

In a further appropriate development of this embodiment, in the region where it merges into the sealing element, the rib runs as far as a zone radially remote from the sealing projection. In this manner an unbraced and hence elastic region remains axially between the rib and the projection.

In a further development of this embodiment, in the region where it merges into the bottom, the rib runs as far as a zone which is radially remote from the axis or center of the closure component. This feature opposes degradation of bottom bulging with increasing pressure and hence the action as an overpressure valve is improved.

Lastly, the cross-sectional slimming is radially configured in such manner in a further development of the invention that the hinge it forms lies on the conceptually extended inside surface of the neck of a bottle. On account of this position of the slimming and hence of the hinge, the radially sealing projection resting against the inner wall of a bottle neck will only be pressure relieved or detached transversely to the inside surface of the bottle neck when the bottom of the closure cap bulges. In this manner axial frictional motions between the sealing projection along the inside surface of the bottle neck are opposed and thus also wear and leakage.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is a cross-sectional and partial cutaway view of a closure component made in accordance with the present invention.

The invention is elucidated by an illustrative embodiment and in relation to a drawing.

DETAILED DESCRIPTION OF THE INVENTION

The drawing is a cross-section and partial cutaway view of a closure component 1 designed as a screw cap and screwed onto a bottle neck 2 only shown at its front part. The closure component 1 comprises a bottom 3 from which a cylindrical sealing part 4 runs axially inside the neck 2, said sealing part 4 comprising at its outside a projection 5 resting against a cylindrical inside surface 6 of the neck 2. The outside diameter of the projection 5 is slightly larger than the diameter of the inside surface 6 in such manner that the projection 5 when in its screw-on condition as shown, rests at a specified force against the inside surface 6. Accordingly the projection 5 is precluded from making contact with a front, inside edge 7 of the mouth of the neck 2.

Directly radially outside the sealing element 4, the bottom 3 comprises a cross-sectional slimming 8 forming a hinge; an elbow lever formed by the sealing element 4 and that part of the bottom 3 running radially inward from the cross-sectional slimming 8 is pivotable about said hinge.

An external and cylindrical retaining element 12 of the closure means 1 comprises an inner thread 13 at its inside to engage an outside thread 14 of the bottle neck 2. Also a stop 10 is present inside at the retaining element 12 and makes contact with a mating stop 11 formed at the top end of the bottle neck 2. In this manner the stop 10 and the mating stop 11 constrain an accurate and in particular a fixed position of the hinge formed by the cross-sectional slimming.

A rib 15 is mounted in the region of the angle between the bottom 3 and the sealing element 4 and is rigidly affixed to said bottom 3 and sealing element 4 and is integral with them. The rib 15 is triangular and runs radially as far as a zone which is away from the sealing projection 5 but ends in a radial zone away from the axis 16. Because of this slight radial inward dimension, the bracing of the bottom 3 is kept small with respect to bulging.

In use, and after filling the bottle with the neck 2 being discussed, the cap-shaped closure means 1 is screwed onto the neck 2 until the stop 10 comes to rest against the mating stop 11. In this process, the projection 5 at the sealing element 4 glides onto the inside surface 6 of the neck 2 and thusly seals the bottle-inside. If overpressure is generated in the bottle, for instance in case the beverage is gas-pressure generating, the bottom 3 will bulge outward so that its rims rotate about the cross-sectional slimming 8 representing a hinge. As a result, the arm formed by the sealing element 4 pivots radially inward and thereby the force with which the projection 5 presses against the inside surface 6 of the neck 2 is reduced. At a predetermined overpressure and hence at a predetermined bulging of the bottom 3, the projection 5 detaches off the inside surface 6, allowing the overpressure to escape. Thereby the bulge of the bottom 3 decreases and the projection 5 again comes to rest tightly against the inside surface 6. The rib 15 improves the transmission of the deviation of the bottom 3 caused by overpressure-bulging to the sealing element 4 and the elbow lever formed by the bottom 3 and the sealing element 4 is braced thereby. As a consequence the overall overpressure valve operates more sensitively and accurately to overpressure. In particular a specified blowoff pressure is more easily observed even at varying manufacturing tolerances.

Because the position of the hinge formed by the cross-sectional slimming 8 is made practically invariant by the stop 10 and the mating stop 11, axial displacements of the sealing element 4 are practically precluded and also relative motions between the projection 5 at the sealing element 4 and the inside surface 6 of the neck 2. Therefore the sealing effect remains unaffected even when frequent changes in pressure cause changes in the bulging of the bottom 3. Such changes merely entail changes in resting pressure by the projection 5 that however do not degrade sealing.

I claim:

1. A closure means for a bottle, comprising:

a) a cap-shaped closure component;

b) a projection directed inwardly from an edge of said cap-shaped closure component adapted to engage an outwardly directed projection at a neck of a bottle;

c) a substantially cylindrical sealing element extending axially from a bottom of said closure component, said sealing element being disposed within said closure component;

d) a radial projection extending from a radially outwardly facing surface of said sealing element and disposed away from said bottom and having a diameter larger than the inside diameter of the neck of the bottle to be sealed by said closure means in such a way that a sealing surface formed by said radial projection tightly rests against an inside surface of the neck in a closed mode;

e) said bottom comprises a cross-sectional slimming disposed radially beyond said cylindrical sealing element, said slimming has a thickness less than the thickness of an adjacent portion of said bottom such that said slimming functions as a hinge;

f) said bottom and said sealing element form an elbow lever pivotable about said hinge; and

g) at least one rib disposed in a space formed between said bottom and said sealing element to brace said sealing element against movement relative to said bottom, such that upon bulging of said bottom said radial projection is substantially radially detached from the inside surface of the neck by a lever action of said elbow lever pivotable about said hinge.

2. Closure means as in claim **1**, wherein said sealing element comprises an axial stop radially disposed beyond said cross-sectional slimming to rest against an opposite mating stop at the neck.

3. Closure means as in claim **2**, wherein said axial stop is adapted positioned in a radial region of a top end of the neck forming said mating stop.

4. Closure means as in claim **1**, wherein said at least one rib runs axially along said sealing element as far as into a zone away from said radial projection in a region merging into said sealing element.

5. Closure means as in claim **4**, wherein in said region said rib terminates radially away from an axis of said closure component.

6. Closure means as in claim **1**, wherein said rib is triangular.

7. Closure means as in claim **1**, wherein said cross-sectional slimming is disposed radically inwardly of a radially outermost surface of the radial projection.

* * * * *

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United States Patent [19]

Beck et al.

[11] Patent Number: 5,297,688

[45] Date of Patent: Mar. 29, 1994

[54] CLOSURE FOR SEALING A CONTAINER RIM

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[73] Assignee: Creative Packaging Corp., Buffalo Grove, Ill.

[21] Appl. No.: 992,136

[22] Filed: Dec. 17, 1992

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 845,373, Mar. 3, 1992, abandoned.

[51] Int. Cl.[5] B65D 53/00

[52] U.S. Cl. 215/344; 215/343; 215/354; 215/DIG. 1

[58] Field of Search 215/341, 344, 343, 354, 215/DIG. 1

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Primary Examiner—Allan N. Shoap
Assistant Examiner—Vanessa Caretto
Attorney, Agent, or Firm—Silverman, Cass & Singer, Ltd.

[57] ABSTRACT

A closure for sealing a rim of an open mouth of a container including a substantially cylindrical end cap closed at a first end thereof by a top surface, open at a second opposite end thereof and including an annular side wall having a predetermined width extending between the first and second ends, the top surface including a first inside surface facing the interior of the end cap and a second exterior surface facing the exterior of the end cap, a first flexible seal member connected to and depending a predetermined distance from the first inside surface of the top surface proximate the annular side wall for cooperative sealing engagement with an outer edge of the container rim and for inhibiting outward distortion of the container rim, and a second flexible seal member connected to and depending a predetermined distance from the first inside surface of the top surface and within the confines of the first seal member for sealing engagement with an inner edge of the container rim and for inhibiting inward distortion of the container rim, the rim substantially being accepted between the first and second seal members which seal the exterior and interior edges of the rim, respectively, to prevent leakage of the container contents and contamination of the contents from elements outside the container.

11 Claims, 2 Drawing Sheets

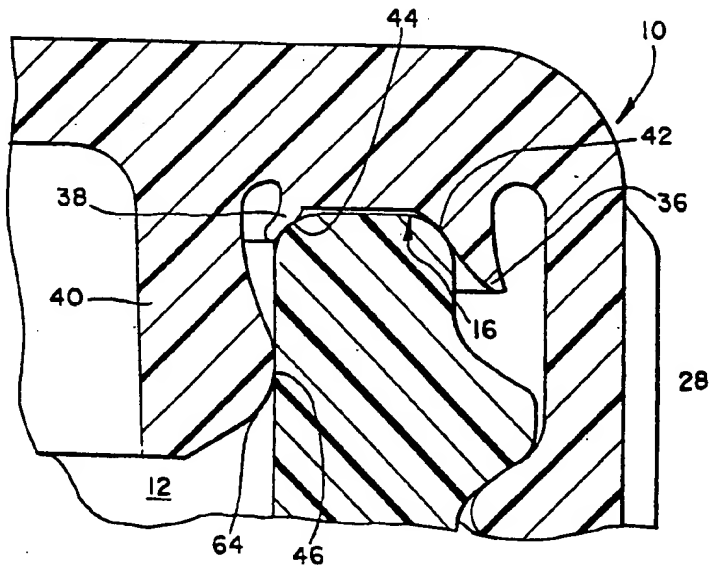

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Fig. 1

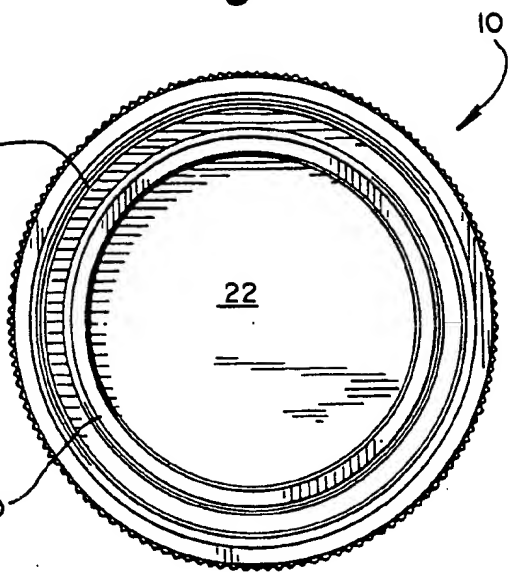

Fig. 6

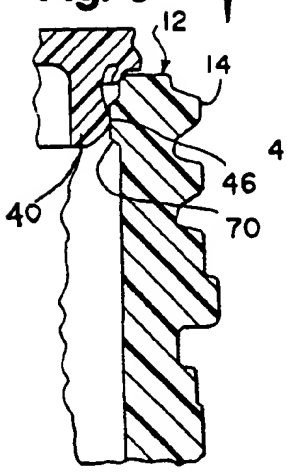

Fig. 5

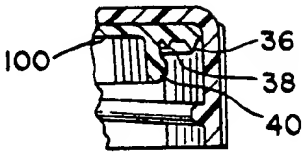

Fig. 2

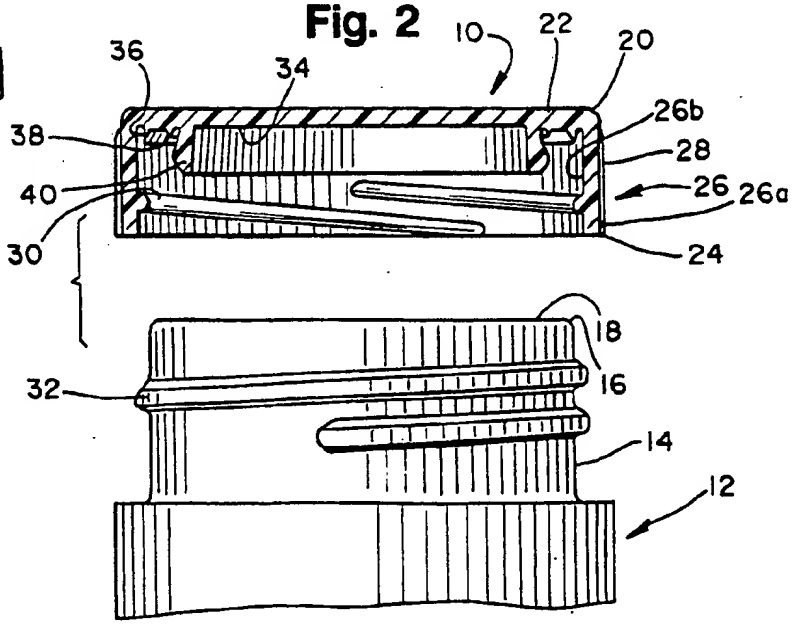

Fig. 3

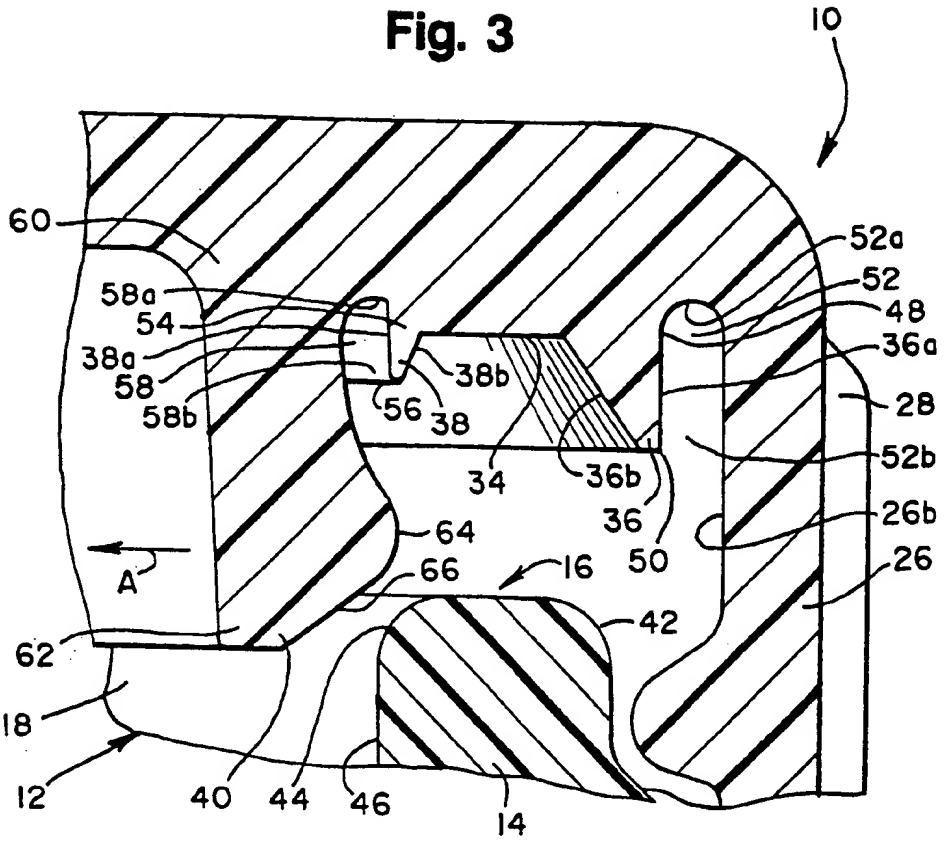
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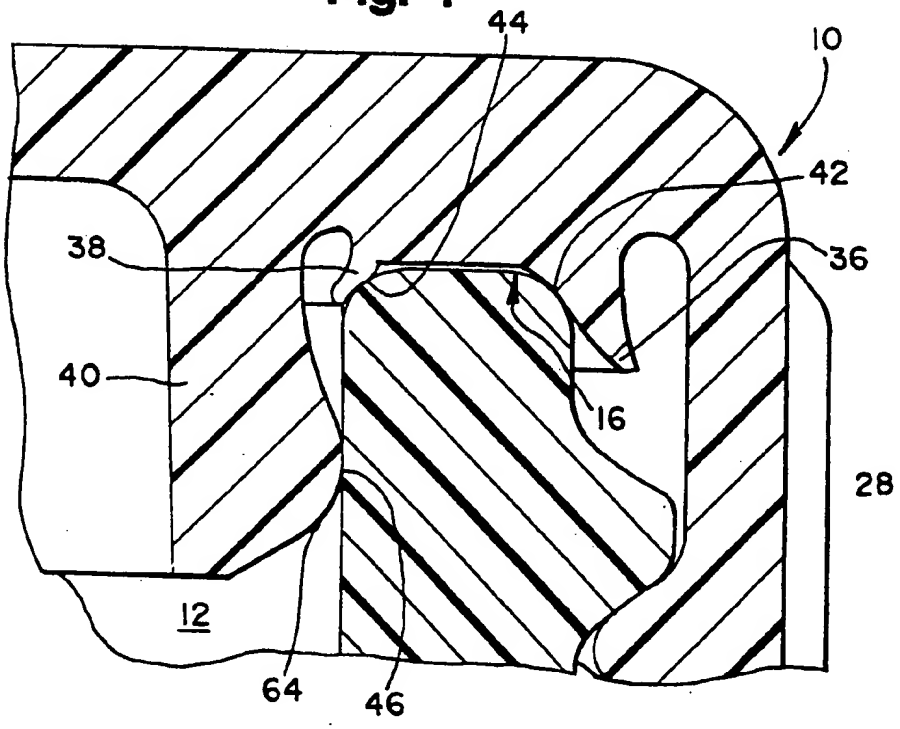
Fig. 4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CLOSURE FOR SEALING A CONTAINER RIM

This application is a continuation-in-part of application No. 07/845,373 filed Mar. 3, 1992, now abandoned, which is owned by the same assignee as the assignee herein.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to closures for containers, and more particularly to a closure which seals a rim of an open mouth of a container at a plurality of discrete locations along the surface of the rim and container mouth where each location provides a seal over a significant portion of the surface of the container and stabilizes both the interior and exterior surfaces of the container mouth from distortion during and after installation of the closure.

2. Description of the Related Art

Closures or caps for containers typically are of the threaded screw or snap type construction and are utilized to close the mouth of the container in either a resealable or non-resealable manner. Manufacturers of products which utilize such closures typically require a closure to perform under several conditions or specifications which vary from product to product and between manufacturers.

One condition or specification is that a closure be capable of being applied to a container when the container and/or the contents therein still are hot or where the container and contents are heated after application of the closure. In such a situation, temperatures of the contents can exceed 150° which can distort the container mouth from its circular shape. Accordingly, closures utilized in such applications must not only ensure proper sealing about the container mouth or rim, but must assist in maintaining the circular shape of the container mouth during and after application of the closure.

Furthermore, containers frequently are sealed with a closure where a vacuum is provided within the container. Thus, these types of closures initially must seal the container against an inward pressure force provided by the vacuum. After opening, the same closure must then seal the container against an outward pressure force which can be provided by the weight of the container contents themselves as well as any gas pressure which may be generated by the contents, such as gas pressure provided by a carbonated beverage.

To provide a leak-proof seal about the rim of the container mouth, closures can include separate liners or be molded to include one or more rim engagement member that resists leakage of the container contents. Separate liners typically are attached to the inside closed end of the closure and can require increased manufacturing costs to insert and secure the liner to the closure and/or modify the closure to accept the liner.

An example of a closure having a molded rim engagement member is shown in U.S. Pat. No. 4,122,965 which includes one non-flexing sealing fin which projects downwardly from the closed end of the closure to engage the container rim proximate the center of the width of the rim. Such a sealing fin, however, only provides contact with the center of the rim along a single engagement line which may not provide an adequate seal, especially with container contents under pressure. Additionally, the sealing fin is crushed and deformed during installation which can restrict proper resealing of the closure upon reinstallation on the container.

U.S. Pat. No. 4,220,250 similarly discloses a closure having one sealing ring extending from an internal surface of a closure whose flexing is limited by an additional support ring depending from the closed end of the closure and which provides enhanced sealing with increased pressure within the container. A bead also is included on the internal surface of the closure side wall for locating and centering of the closure as it is finally tightened on the container. As with the closure described above, sealing is provided by a bead formed on the sealing ring that only provides contact with the center of the rim along a single engagement line. Additionally, an initial vacuum within the container may cause the structure that provides the enhanced sealing to open and enable the contents to leak out.

U.S. Pat. No. 4,360,114 discloses a closure having two resilient concentric sealing rings depending from the top portion of the cap where the outer sealing ring is longer. Both rings, however, contact the central portion of a tapered container rim and flex outward which can cause leakage from outward pressure within the container causing outward flexing of the rings.

It therefore is desirable to provide a closure which can seal a container rim, even when the container and/or contents are subjected to heat or where excess pressure or a vacuum is provided within the container, where the closure engages the container rim and mouth in a plurality of locations and provides sealing over a significant portion of the surface area of the container and which stabilizes both the interior and exterior surfaces of the container from distortion during and after installation of the closure.

SUMMARY OF THE INVENTION

The invention provides a closure for sealing a rim of an open mouth of a container. The closure includes a substantially cylindrical end cap closed at a first end thereof by a top surface, open at a second opposite end thereof and including an annular side wall having a predetermined width extending between the first and second ends. The top surface includes a first inside surface facing the interior of the end cap and a second exterior surface facing the exterior of the end cap. A first flexible seal member is connected to and depends a predetermined distance from the first inside surface of the top surface proximate the annular side wall for cooperative sealing engagement with an outer edge of the container rim and for inhibiting outward distortion of the container rim. A second flexible seal member also is connected to and depends a predetermined distance from the first inside surface of the top surface and within the confines of the first seal member for sealing engagement with an inner edge of the container rim and for inhibiting inward distortion of the container rim, the rim substantially being accepted between the first and second seal members which seal the exterior and interior edges of the rim, respectively, to prevent leakage of the container contents and contamination of the contents from elements outside of the container.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a bottom plan view of a closure illustrating the sealing members of the invention formed on the inside top surface thereof;

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1 in the direction indicated generally illustrating

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the closure in juxtaposition with a container neck and mouth illustrated in elevation;

FIG. 3 is an enlarged fragmentary sectional view of the closure of the invention illustrating the sealing members prior to engagement with a container rim; and

FIG. 4 is an enlarged fragmentary sectional view of the closure of the invention, similar to FIG. 3, illustrating the sealing members after engagement with the container rim and sealing thereof;

FIG. 5 is an enlarged cross-sectional view of a portion of the cap of the invention illustrating a separate liner; and

FIG. 6 is an enlarged cross-sectional view of a portion of the container mouth illustrating another feature of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 2, the closure or cap of the invention is designated generally by the reference numeral 10. The cap 10 preferably is made of plastic and designed for threaded engagement with a container 12 about a neck portion 14 for sealing a top rim 16 about an open mouth 18 of the container 12 as will be described below. It is to be understood, however, that the material of the cap 10 as well as the container 12 can vary and the cap 10 can be utilized in a variety of applications.

The cap 10 preferably is substantially cylindrical in shape and includes a first end 20 closed by a top surface 22, a second opposite open end 24 and an annular side wall 26 interconnecting the first end 20 and the second end 24. Preferably, to assist in gripping the outside surface of the cap 10, the exterior surface 26*a* of the annular side wall 26 can include a plurality of ribs 28. Additionally, the interior surface 26*b* of the annular side wall 26 is formed with threads 30 for cooperative threaded engagement with corresponding threads 32 on the container 12. The cap 10, however, can be designed for snap-type engagement or a combination of threaded and snap engagement with the container 12 (not illustrated) if desired.

The top surface 22 of the first closed end 20 of the cap 10 includes an interior surface 34. In order to seal the top rim 16 of the open mouth 18 of the container 12 against leakage, the interior surface 34 includes three depending concentric annular sealing flanges or fins: a first outer sealing flange 36; a second intermediate sealing flange 38 and a third inner sealing flange 40.

Preferably, the three flanges 6, 8 and 40 are somewhat flexible and ere integrally formed with and depend outwardly away from the interior surface 34. It is to be understood, however, that the three flanges 36, 38 and 40 may be of any shape and size, may not be annular and could be provided in the form of one or more separate assemblies or liners, such as liner 100 in FIG. 5, which then are secured to the interior surface 34, if desired.

Briefly, as FIG. 4 illustrates, in operation when the cap 10 is threadedly applied to the container 12, the first outer flange 36 seals an outer edge 42 of the top rim 16 of the container 12 and the second intermediate flange 38 seals an inner edge 44 of the top rim 16. The third inner flange 40 seals an inside surface 46 of the neck 14 of the container 12. Details of the sealing of the three flanges 36, 38 and 40 will be discussed hereinafter.

As FIG. 3 illustrates, the first outer flange 36 substantially is triangular in cross-sectional configuration and forms an annular fin or ring depending from the interior surface 34 of the cap 10. The first outer flange 36 includes a first proximal end 48, connected to the interior surface 34 of the cap 10, and a second opposite distal end 50, formed at a distance from the first proximal end 48. Thus, the second distal end 50 depends a predetermined distance outwardly away from the interior surface 34 of the cap 10 to provide the desired engagement with the outer edge 42 of the rim 16.

Preferably, to allow for outward flexing of the first outer flange 36 within the confines of the cap, 10, the first flange 36 includes a first outside surface 36*a* and a second tapered inside surface 36*b* which tapers from the first proximal end 48 to the second distal end 50 of the first outer flange 36.

The first outside surface 36*a* is spaced a predetermined distance from the interior surface 26*b* of the annular side wall 26 of the cap 10 by a first annular slot 52 having a length extending substantially parallel to the interior surface 26*b*. The first slot 52 has a first closed end 52*a* and a second open end 52*b* which opens to the interior of the cap 10 facing the second open end 24 of the cap 10. It is to be noted that the first closed end 52*a* is rounded and extends into the interior surface 34 of the cap 10 a predetermined distance to assist in flexing of the first flange 36 and provide a point of rotation for the first flange 36.

Similarly, the second intermediate flange 38 substantially is triangular in cross-sectional configuration and forms an annular fin or ring depending from the interior surface 34 of the cap 10. The second flange 38 includes a first proximal end 54, connected to the interior surface 34 of the cap 10, and a second opposite distal end 56, formed at a distance from the first proximal end 54. Thus, the second distal end 56 depends a predetermined distance outwardly away from the interior surface 34 of the cap 10 to provide the desired engagement with the inner edge 44 of the rim 16.

Preferably, the first outer flange 36 is somewhat longer than the second intermediate flange 38, but the lengths of both the first and second flanges 36 and 38 can vary. To allow for inward flexing of the second flange 38 within the confines of the cap 10, the second flange 38 includes a first surface 38*a* and a second tapered surface 38*b* which tapers from the first proximal end 54 to the second distal end 56 of the second intermediate flange 38.

The first surface 38*a* is spaced a predetermined distance from the third interior flange 40 by a second annular slot 58 having a length extending substantially normal to the interior surface 34 of the cap 10. The second slot 58 includes a first closed end 58*a* and a second open end 58*b* which opens to the interior of the cap 10 facing the second open end 24 of the cap 10. The first closed end 58*a* is rounded and extends into the interior surface 34 of the cap 10 a predetermined distance to assist in flexing of the second flange 38 and provide a point of rotation for the second flange 38.

The third inner flange 40 forms an annular fin or ring depending from the interior surface 34 of the cap 10 and includes a first proximal end 60, connected to the interior surface 34, and a second opposite distal end 62, formed at a distance from the first proximal end 60. Thus, the second distal end 62 depends a predetermined distance outwardly away from the interior surface 34 and preferably is longer than both the first and second flanges 36 and 38 for contact with the interior surface 46 of the neck 14 of the container 12.

To provide contact between the third inner flange 40 and the interior surface 46 of the neck 14, the third

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flange 40 includes an outwardly extending rounded shoulder 64. As FIG. illustrates, before the cap 10 is installed on the container 12 the shoulder 64 is positioned proximate the proximal end 60 of the flange 40 and extends outwardly toward both the first and second flanges 36 and 38 and the annular side wall 26 of the cap 10 to project over the second flange 38. To assist in seating and flexing of the flange 40 as will be described below, the shoulder 64 tapers off along a ramp portion 66 toward the distal end 62 of the flange 40.

As FIG. 3 illustrates, as the cap 10 is installed on the container 12, the ramp portion 66 of the shoulder 64 initially will contact the inner edge 44 of the rim 16. Upon continued installation, the contact between the ramp portion 66 and the inner edge 44 of the rim 16 will force the third flange 40 to the left in the direction of arrow "A" until the shoulder 64 occupies the position illustrated in FIG. 4 where it is spring loaded against the inside surface 46 of the neck 14.

As the third flange 40 is being flexed, the outer and inner edges 42 and 44 of the rim 16 engage the first and second flanges 36 and 38, respectively, which then are flexed in opposite directions. This flexing is accomplished due to the shape of the outer and inner edges 42 and 44 and the flexibility and shape of the first and second flanges 36 and 38 which allows the rim 16 of the container 12 to occupy the final sealed position with respect to the cap 10 as illustrated in FIG. 4.

In this final sealed position, all three flanges 36, 38 and 40 provide sealing engagement along a substantial surface area of the container 12 as opposed to mere line contact. Furthermore, sealing is provided against both an inward pressure provided by a vacuum or an outward pressure provided by the weight of the container contents or gas pressure generated by the container contents.

It also is to be noted that the cooperation between flanges 36, 38 and 40 helps to stabilize both the inside and outside portions of the mouth 18 of the container 12 and prevent it from distorting. This is especially important when the container 12 or the contents are heated before or after application of the cap 10.

Additionally, the design of the flanges 36, 38 and 40 enables a cap 10 to be utilized with a range of sizes and tolerances of the mouth 18 and rim 16, which can have edges 42 and 44 of different shapes including squared off edges (not illustrated.) This is due to the flexibility of the flanges 36, 38 and 40, the use of the tapered surfaces 36*b* and 38*b* of the flanges 36 and 38, slots 52 and 58 and the cooperative engagement with the rim 16.

As FIG. 6 illustrates, in order to minimize the drag of the third inner flange 40 against the inside surface 46 of the neck 14 of the container 12, the inside surface 46 can be enlarged in diameter and formed to include an internal rib 70. Thus, when the cap 10 is installed on the container 12, the third inner flange 40 does not deflect in the direction of arrow "A" until it engages the internal rib 70. This engagement also enables more thread contact area between the cap 10 and container 12.

Modification and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed and desired to be secured by letters patent of the United States is:

1. A closure for sealing a rim of an open mouth of a container, the rim having a top surface, an outside surface, an inside surface, a first transitional corner between said top surface and said outside surface and a second transitional corner between said top surface and said inside surface, the closure comprising:

a substantially cylindrical end cap closed at a first end thereof by a top surface, open at a second opposite end thereof and including an annular side wall having a predetermined width extending between said first and second ends, said top surface including a first inside surface facing an interior of said end cap and a second exterior surface facing an exterior of said end cap;

first flexible seal means connected to and depending a predetermined distance from said first inside surface of said top surface proximate said annular side wall for cooperative sealing engagement with said first corner of said container rim and for inhibiting outward distortion of said container rim and a space defined between said side wall and said first seal means;

second flexible seal means connected to and depending a predetermined distance from said first inside surface of said top surface and within the confines of said first seal means for cooperative sealing engagement with said second corner of said container rim and for inhibiting inward distortion of said container rim, said first and second seal means forming a channel therebetween for receiving said container rim therein to prevent leakage of container contents, contamination of the contents from elements outside the container and inhibiting outward and inward distortion of the container rim;

third flexible seal means connected to and depending a predetermined distance from said first inside surface of said top surface and within the confines of said second seal means for sealing engagement with an internal surface of the container mouth and for inhibiting inward distortion of a container neck, and a space defined between said second seal means and said third seal means; and

said channel being radially larger than the space between the side wall and the first seal means, and said channel being radially larger than the space between the second seal means and the third seal means, the first and second seal means being sufficiently spaced from the side wall and the third seal means, respectively, so that they remain free of contact with the side wall and third seal means at all times.

2. The closure as defined in claim 1 wherein said first, second and third seal means are annular.

3. The closure as defined in claim 1 wherein said first and second seal means provide sealing engagement over a predetermined portion of a surface area of said container.

4. The closure as defined in claim 1 wherein said first, second and third seal means provide sealing engagement over a predetermined portion of a surface area of said first and second corners of said container rim and said inside surface, respectively.

5. The closure as defined in claim 1 wherein said first and second seal means are integrally formed with said first inside surface of said top surface of said end cap.

6. The closure as defined in claim 1 wherein said first and second seal means are formed as at least one separate liner member which is connected to said first inside surface of said top surface of said end cap.

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7. The closure as defined in claim 1 wherein said first, second and third seal means are integrally formed with said first inside surface of said top surface of said end cap.

8. The closure as defined in claim 1 wherein said first, second and third seal means are formed as at least one separate liner member which is connected to said first inside surface of said top surface of said end cap.

9. The closure as defined in claim 1 wherein said internal surface includes an annular rib for sealing engagement with said third seal means.

10. A container and a closure for sealing a rim of an open mouth of said container, the container rim having a substantially horizontal top surface, a substantially vertical outside surface, a substantially vertical inside surface, a first substantially arcuate curved transitional corner between said top surface and said outside surface and a second substantially arcuate curved transitional corner between said top surface and said inside surface, the closure comprising:

a substantially cylindrical end cap closed at a first end thereof by a top surface, open at a second opposite end thereof and including an annular side wall having a predetermined width extending between said first and second ends, said top surface including a first inside surface facing an interior of said end cap and a second exterior surface facing an exterior of said end cap;

first flexible seal means connected to and depending a predetermined distance from said first inside surface of said top surface proximate said annular side wall for cooperative sealing engagement with said first corner of said container rim and for inhibiting outward horizontal distortion of said container rim; and

second flexible seal means connected to and depending a predetermined distance from said first inside surface of said top surface and within the confines of said first seal means for cooperative sealing engagement with said second corner of said container rim and for inhibiting inward radial distortion of said container rim, said first and second seal means forming a channel therebetween for receiving said container rim therein to prevent leakage of container contents, contamination of the contents from elements outside the container and inhibiting outward and inward radial distortion of the container rim; and

third flexible seal means connected to and depending a predetermined distance from said first inside surface of said top surface and within the confines of said second seal means for sealing engagement with said substantially vertical inside surface of said container rim and for inhibiting inward radial distortion of said container rim.

11. The container and closure as defined in claim 10, wherein said final position of said container rim with respect to said closure is spaced from said annular side wall of said closure.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,297,688
DATED : March 29, 1994
INVENTOR(S) : James M. Beck, Terry E. Kubitz and Alex Kutaj

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

Column 3, line 49, change "6, 8" to --36, 38--;

Column 3, line 50, change "ere" to --are--;

Column 5, line 2, after "FIG." insert --3--;

Column 6, line 18, after "rim" insert a comma (,).

Signed and Sealed this

Nineteenth Day of July, 1994

Attest:

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

United States Patent [19]

Breuer

[11] **Patent Number: 4,564,112**

[45] **Date of Patent: Jan. 14, 1986**

[54] **CLOSURE CAP FOR A CONTAINER**

[75] Inventor: **Hans-Werner Breuer**, Himmelried, Switzerland

[73] Assignee: **Crown Obrist AG**, Reinach, Switzerland

[21] Appl. No.: **638,476**

[22] PCT Filed: **Dec. 28, 1983**

[86] PCT No.: **PCT/CH83/00149**

§ 371 Date: **Jul. 26, 1984**

§ 102(e) Date: **Jul. 26, 1984**

[87] PCT Pub. No.: **WO84/02694**

PCT Pub. Date: **Jul. 19, 1984**

[30] **Foreign Application Priority Data**

Jan. 7, 1983 [CH] Switzerland 84/83

[51] **Int. Cl.**[4] **B65D 41/54**

[52] **U.S. Cl.** **215/246**; 215/252

[58] **Field of Search** 215/246, 252

[56] **References Cited**

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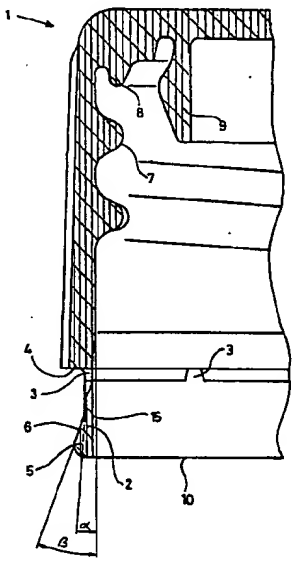
Primary Examiner—Donald F. Norton
Attorney, Agent, or Firm—William R. Hinds

[57] **ABSTRACT**

In a closure cap (1) of thermoplastic material, produced by an injection moulding process, the guarantee strip (2) which is formed integrally thereon is provided, at the lower edge (2) of the closure cap, on the outside (6), with a reinforcement portion (5) which is disposed between two desired-rupture connecting web portions (3). Besides the advantages, which are already known, of a reinforcement portion on the guarantee strip, the reinforcement portion according to the invention serves as a support for bearing against the moulding tool in order to prevent stretching of the connecting web portions (3) or deformation of the guarantee strip (2) when the cap is removed from the mould.

4 Claims, 11 Drawing Figures



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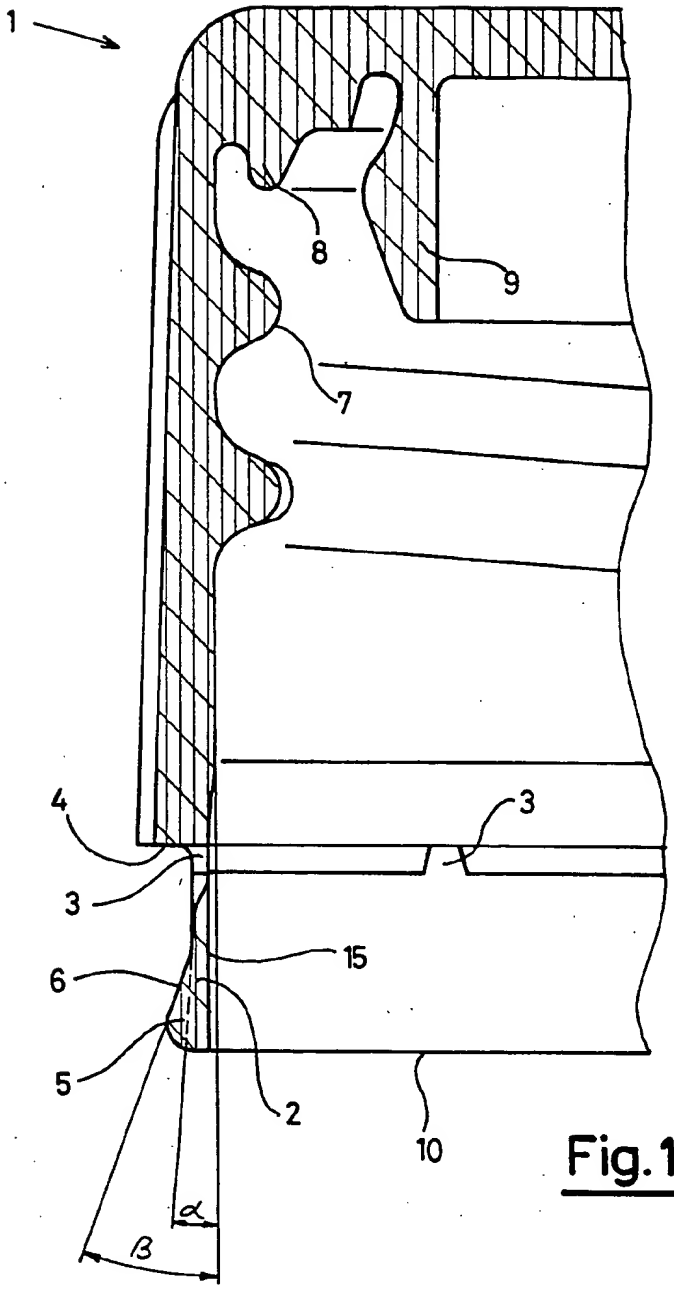


Fig. 1

Fig. 2

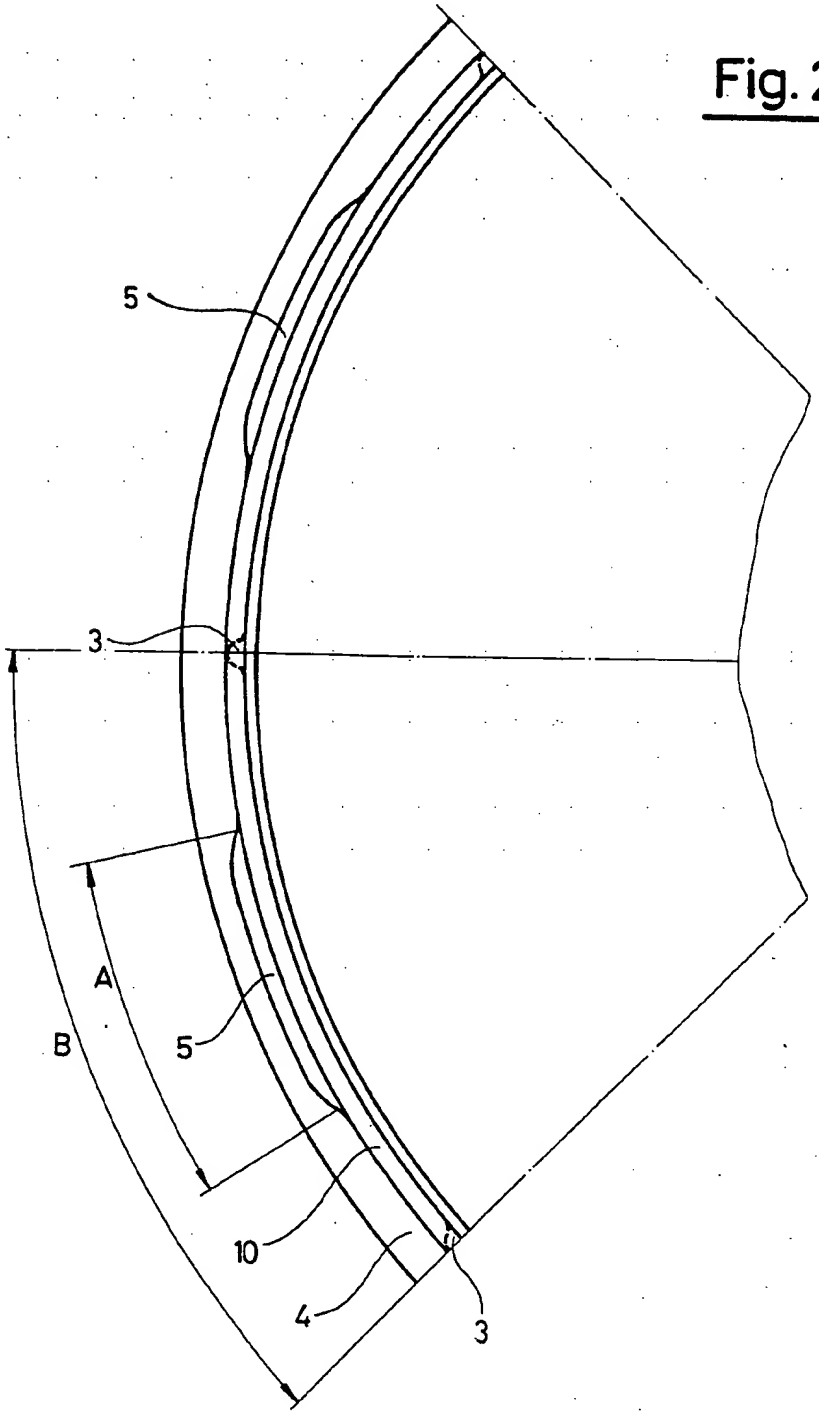


Fig. 3

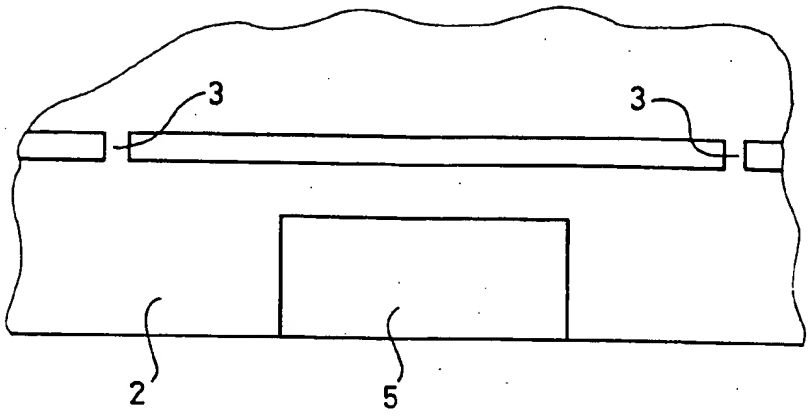
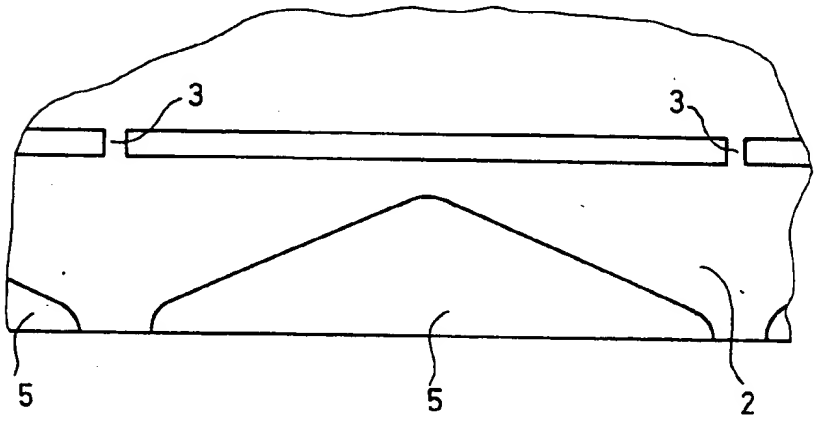


Fig. 4



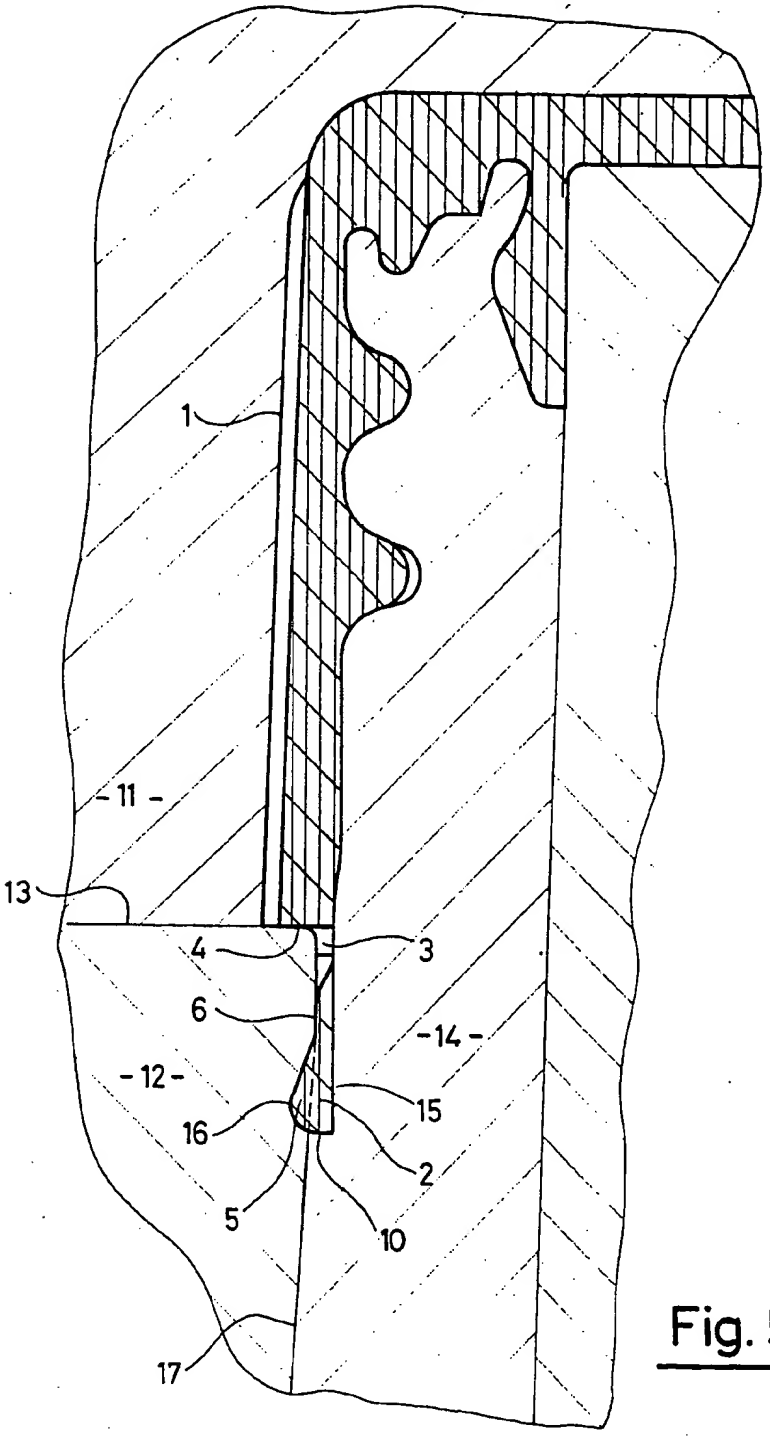


Fig. 5

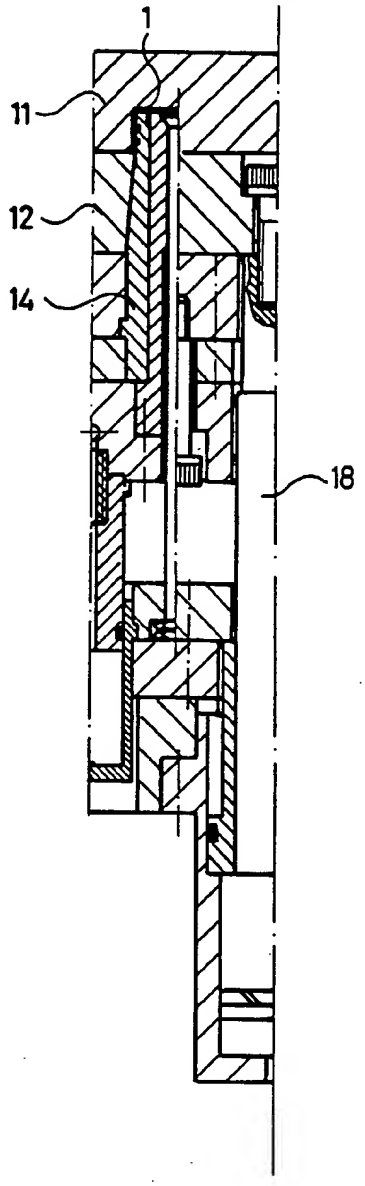


Fig. 6

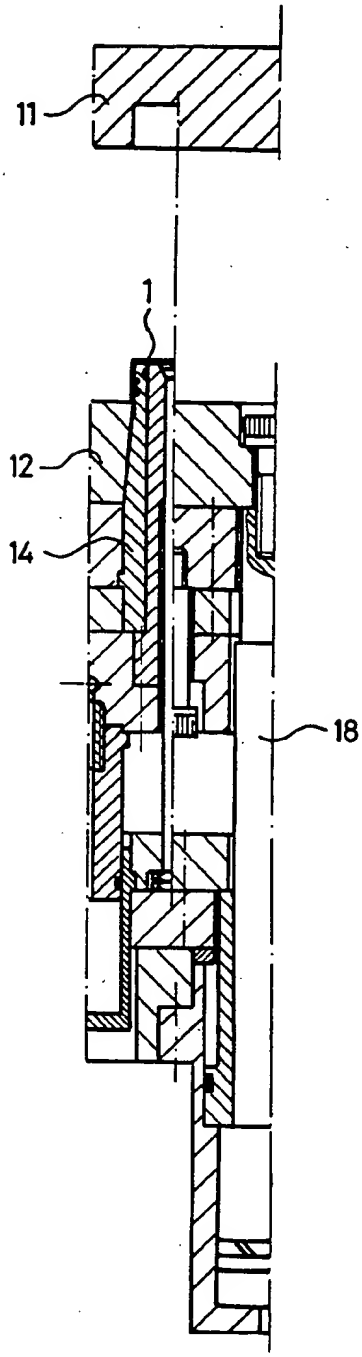


Fig. 7

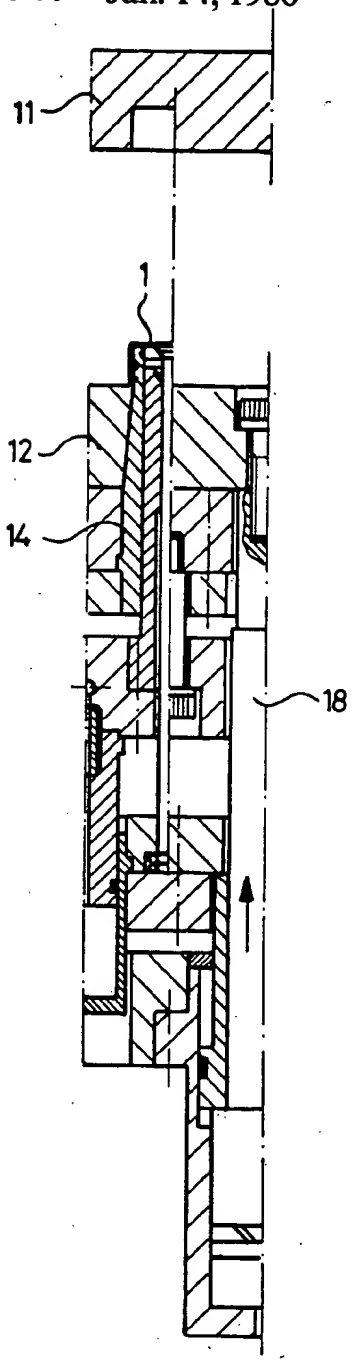


Fig. 8

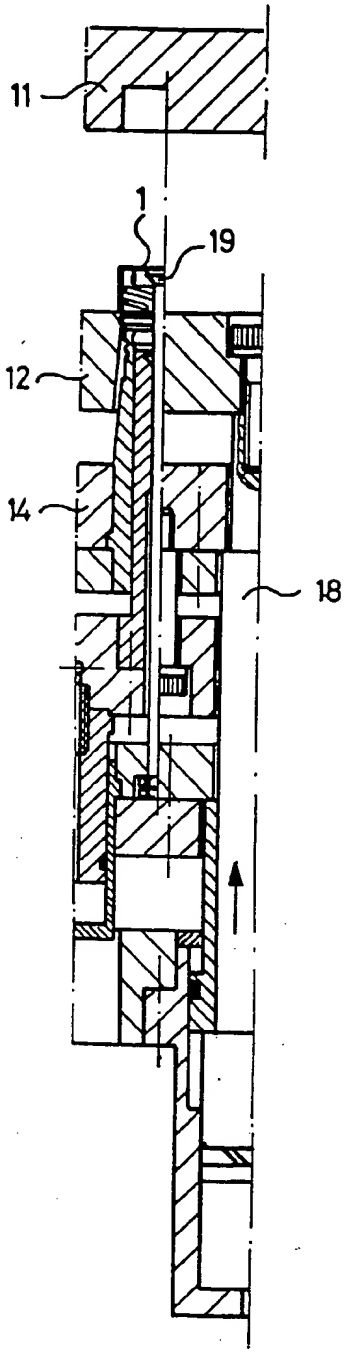


Fig. 9

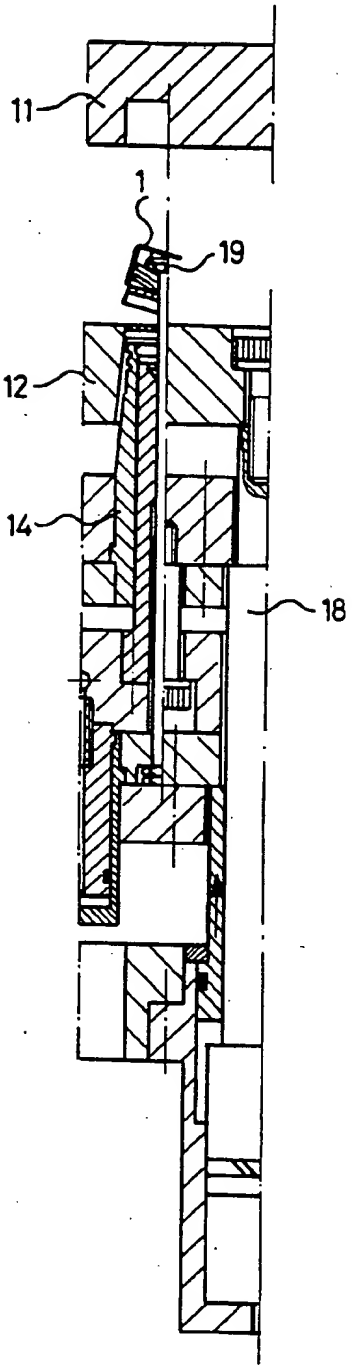


Fig. 10

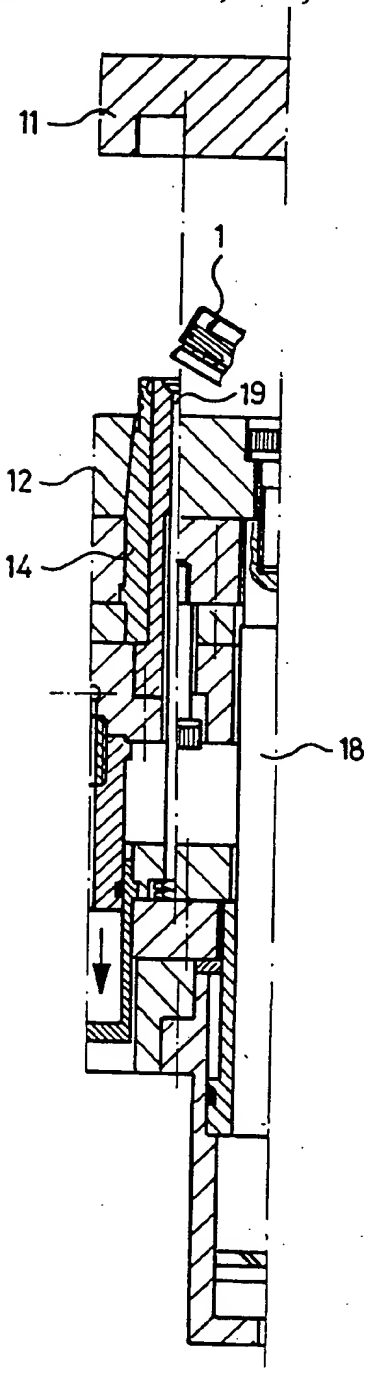


Fig. 11

CLOSURE CAP FOR A CONTAINER

The invention relates to a closure cap for a container, the cap being of the type which is provided with a heat-shrinkable guarantee strip and is produced integrally with the guarantee strip from thermoplastic material in an injection molding process, wherein the guarantee strip is connected to the lower edge of the closure cap by way of a plurality of rupturable connecting web portions and is intended at least partially to embrace the neck of the container and can be brought into engagement therewith by heat-shrinking, and wherein the wall thickness of the guarantee strip has a reinforcement portion in the region between each two rupturable connecting web portions and the individual reinforcement portions are interrupted and spaced apart by portions of smaller wall thickness.

A closure cap of the kind indicated above is described for example in the European patent publication No. 34,997, published on Sept. 2, 1981. In accordance with that specification, the guarantee strip is provided on the inward side with a chord-like reinforcement, the purpose of which is to enhance the flow behaviour of the thermolastic material in the injection moulding operation. In addition, the reinforcement is intended to facilitate the operation of shrinking the guarantee strip on to the neck of the container by means of the effect of heat.

It has now been found that the dimensions of the reinforcement on the inward side of the guarantee strip can only lie within a restricted range as in that respect the dimensions and the configuration of the neck of the container must be taken into account. In addition, problems still occur when removing the closure cap from a moulding tool which opens in an axial direction, but those problems are not directly related to the reinforcement on the guarantee strip. More specifically, when stripping the closure cap from the inner tool portion, the guarantee strip is subjected to forces which act in the opposite direction to the direction of ejection from the mould and which pull the guarantee strip downwardly. As a result of that, undesirable stretching occurs at the connecting web portions which form the desired rupture locations, as the thermoplastic material is still relatively hot and stretchy after the injection moulding operation. On being removed from the mould, the guarantee strip may be deformed in particular in the region between two desired-rupture connecting web portions, in such a way that it is no longer capable of being brought into proper engagement with the neck of the container.

The object of the present invention is therefore to provide a closure cap of the kind set forth in the opening part of this specification, wherein the thickened portion on the guarantee strip can be better dimensioned in accordance with the requirements involved, and wherein in addition the operation of removing the cap from the injection moulding tool can be carried out without damaging or causing deformation of the guarantee strip.

In accordance with the invention, that object is achieved by a screw cap which includes the features that the reinforcement portions are arranged on the outward side of the guarantee strip, and the cross-sections of the reinforcement portions increase toward the lower edge of the guarantee strip.

By virtue of the reinforcement portion being disposed on the outward side of the guarantee strip, the reinforcement portion can be made of larger dimensions, as required, than would be possible in the case of a reinforcement portion disposed on the inward side of the guarantee strip. As will be described in detail hereinafter, the reinforcement portion also serves as an aid to stripping the cap out of the injection moulding tool, insofar as the guarantee strip itself is retained in the tool by the reinforcement portion upon relative movement of the internal mandrel. The fact that the cross-section of the reinforcement portion increases towards the lower end of the guarantee strip provides that the guarantee strip bears against the tool when the cap is stripped from the internal mandrel, but that nonetheless the step of ejecting the closure cap in the opposite direction is not made unnecessarily difficult.

Good properties in regard to shrinkability of the guarantee strip and the flow properties of the injection moulding material are achieved if the reinforcement portion is of substantially square or rectangular configuration in plan and extends over a sector which is equal to or smaller than half the sector between two desired-rupture connecting web portions. In some situations of use, it may also be advantageous for the reinforcement portion to be of a substantially triangular configuration, with one side of the triangle extending substantially parallel to the bottom edge of the guarantee strip.

There is also disclosed an apparatus for producing a closure cap of the kind set forth, which is simple in manufacture and which produces fault-free closure caps at high rates of output. Such an apparatus comprises an upper tool portion for forming the outside contour of the closure cap, a lower tool portion for forming the lower edge of the closure cap and the outside of the guarantee strip, wherein the plane of contact of the upper and lower tool portions lies in the plane of the lower edge of the closure cap, and comprising an inner tool portion for forming the internal contour of the closure cap and the inside and the lower edge of the guarantee strips, recesses being provided in the lower tool portion on the wall portion forming the outside of the guarantee strip, a respective recess being disposed between each two connecting web portions. The recesses may be relatively easily provided on already existing injection molding tools so that surprising improvements both in the injection molding tool itself and also in the closure cap may be achieved by a relatively simple measure.

Embodiments of the invention are described in greater detail hereinafter and illustrated in the drawings in which:

FIG. 1 shows a view in cross-section of part of a closure cap according to the invention, enlarged by a factor of ten,

FIG. 2 shows a view from below of part of the closure cap shown in FIG. 1,

FIG. 3 shows a side view of a reinforcement portion on the guarantee strip,

FIG. 4 shows a side view of modified embodiment of a reinforcement portion on the guarantee strip,

FIG. 5 shows the closure cap of FIG. 1 in the injection moulding tool in a closed condition, and

FIGS. 6 to 11 show the operations involved in ejecting an injection-moulded cap out of the tool, on a greatly reduced scale.

As shown in FIG. 1, a closure cap 1 is provided, as in per se known manner, with a guarantee strip 2 which is integrally connected to the lower edge 4 of the closure cap by way of desired-rupture connecting web portions

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3. The closure cap illustrated also has a female screwthread 7 for screwing on to the mouth opening of a container having a male screwthread, together with a sealing lip 8 and an internal sealing means 9. It will be appreciated that the closure cap may also be of a different configuration.

It is already known for the cross-section of the guarantee strip to be of a wedge-shaped configuration, with an angle α, because that makes it possible to use tools which open in an axial direction. The guarantee strip 2 is intended to be brought into engagement with a bead portion on the neck of the container so that, when the closure cap 1 is unscrewed, the connecting web portions 3 tear, thereby indicating that the closure cap has already been opened once. In the case of a closure cap in accordance with the illustrated construction, the guarantee strip is shrink fitted on to the neck of the container by the effect of heat. However, the configuration of the guarantee strip may also be altered in such a way that, when the closure cap is screwed on, the guarantee strip comes into engagement on the container, at the neck thereof, without being subjected to the effect of heat.

The configuration of the reinforcement portion 5 on the outward side 6 of the guarantee strip can be seen from FIGS. 1, 2 and 3. The cross-section of the reinforcement portion increases in a bead-like configuration towards the lower edge 10 of the guarantee strip and is of a wedge-like shape which is rounded off at the bottom, wherein, as illustrated, the wedge angle β of the reinforcement portion 5 is substantially larger than the wedge angle α of the guarantee strip 2. The supporting action in the injection moulding tool, which is additionally achieved with the reinforcement portion 5, can be particularly clearly seen from FIG. 2. As viewed from below, the reinforcement portions 5 appear as segment-like projections which can bear against the tool, as can be seen in particular from FIG. 5.

The reinforcement portion may be of a square or rectangular configuration or approximately triangular, as shown in FIG. 4. In that case, the triangles may be of such a configuration that the tips thereof nearly touch, underneath the connecting web portions 3. The reinforcement portions of square or rectangular configuration advantageously extend over a sector A which is equal to or less than half the sector B between two connecting web portions 3.

FIG. 5 shows the planes of separation of the various parts of the tool, in the region of the guarantee strip. The upper tool portion 11 defines the external contour of the closure cap 1. The lower tool portion 12 forms the lower edge 4 of the closure cap and the outward side 6 of the guarantee strip 2. In that arrangement, the lower tool portion 12 has an internal wall surface 17 which flares conically downwardly at the wedge angle of the guarantee strip. The plane of separation 13 between the upper tool portion 11 and the lower tool portion 12 is on the plane of the lower edge 4 of the closure cap 1. The internal contour of the closure cap is formed by an internal tool portion 14 which also defines the inward side 15 of the guarantee strip and the lower edge of the guarantee strip. When the closure cap is stripped off the tool portion 14 by means of the lower tool portion 12, the closure cap itself is supported at the lower edge 4 thereof. The guarantee strip 2 in turn is supported separately by the reinforcement portions 5 which are formed by recesses 16 in the material of the lower tool portion 12. By virtue of that arrangement, the forces applied to the guarantee strip as a result of static friction when the tool portions are opened can no longer result in the connecting web portions 3 being stretched or the guarantee strip 2 being deformed. When the moulding material which reaches the guarantee strip by way of the connecting web portions 3 is injected, the reinforcement portions 5 cause the material to flow together homogeneously in the region between two connecting web portions.

FIGS. 6 to 11 show the individual relative positions of the tool portions when the injection-moulded closure cap is being removed from the mould. Details of such an injection moulding tool are known to the man skilled in the art and will therefore not be described in greater detail herein. The movements of the individual parts of the tool are produced by means of a hydraulic step-wise ejector 18.

In FIG. 6, all parts of the tool are closed so that they are in the same positions as shown in FIG. 5. As illustrated in FIG. 7, the upper tool portion 11 is first raised so as to free the outside of the closure cap 1. In that operation, the closure cap 1 is retained by the inner tool portion 14. The tool portion 14 comprises a plurality of components which are concentrically fitted one into the other, as can be particularly clearly seen from FIG. 8. That is necessary in order to be able to remove the complicated internal contour of the closure cap from the moulding tool. As shown in FIG. 8, the lower tool portion 12 is first raised somewhat, together with the inner tool portion 14, so that the internal sealing means in the closure cap 1 is released. In that movement, the guarantee strip 2 is still embraced by tool portions.

FIG. 9 shows the crucial phase in the operation of removing the moulded component from the tool, wherein the guarantee strip is removed from the moulding tool. The upper tool portion 12 is raised further so that the closure cap, together with the guarantee strip, is stripped from the inner tool portion 14. In that operation, the guarantee strip is supported at the reinforcement portions or at the recesses, as illustrated in FIG. 5. When that phase is concluded, the closure cap 1 is then only held by the lower tool portion 12.

In order for the closure cap to be entirely removed from the tool, a pushrod 19 is extended, to eject the closure cap, as shown in FIG. 10. The pushrod 19 is preferably actuated pneumatically. After the closure cap is ejected, the individual tool portions move back into their original position so that the mould can be closed for a further injection moulding operation. FIG. 11 shows the tool in the condition in which there is only the upper tool portion 11 that still has to be closed.

I claim:

1. A closure cap for a container, which cap is provided with a heat-shrinkable guarantee strip (2) and is produced integrally with the guarantee strip from thermoplastic material in an injection moulding process, wherein the guarantee strip is connected to the lower edge (4) of the closure cap by way of a plurality of rupturable connecting web portions (3) and is intended at least partially to embrace the neck of the container and can be brought into engagement therewith by heat-shrinking, and wherein the wall thickness of the guarantee strip has a reinforcement portion (5) in the region between each two rupturable connecting web portions and the individual reinforcement portions are interrupted and spaced apart by portions of smaller wall thickness, including the improvement in that the reinforcement portions (5) are arranged on the outward side

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(6) of the gurantee strip (2) and that the cross-sections of the reinforcement portions increase towards the lower edge of the guarantee strip.

2. A closure cap according to claim 1 characterised in that at least some of the reinforcement portions are of a substantially square or rectangular cross-section.

3. A closure cap according to claim 2 characterised in that at least some of the reinforcement portions on the guarantee strip extend over a sector (A) which is equal to or smaller than half the sector (B) between two connecting web portions (3).

4. A closure cap according to claim 1 characterised in that at least some of the reinforcement portions are of a substantially triangular configuration in side view, wherein one side of the triangle extends approximately parallel to the lower edge of the guarantee strip.

* * * * *

United States Patent [19]

Aichinger et al.

[11] **Patent Number: 4,489,845**

[45] **Date of Patent: Dec. 25, 1984**

[54] **SCREW-CAP FOR CONTAINER**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**³ **B65D 53/00**

[52] **U.S. Cl.** **215/329**; 215/341; 215/344; 215/DIG. 1

[58] **Field of Search** ..... 215/329, 341, 344, DIG. 1

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Primary Examiner—Donald F. Norton
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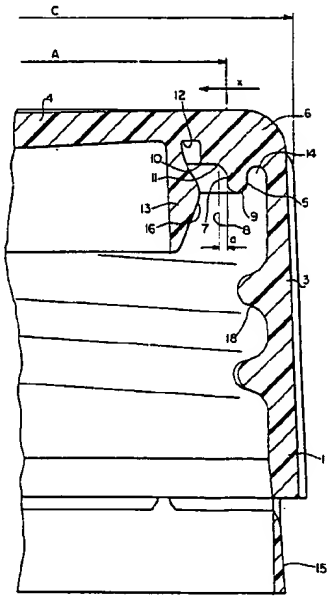
[57] **ABSTRACT**

A screw-cap (1) for closing a container mouth has a sealing lip (5), which is affixed to the cap top (4). The inner side-wall (7) of the sealing lip (5) has a diameter (A) which is greater than the outer diameter (B) of the container outer wall (8). A clamping device, which can be designed as an inner seal (13), creates a contraction of the cap top when the screw-cap is screwed on to the container, by which means the sealing lip (5) is pressed against the container mouth (8). In this manner the sealing lip (5) is only pressed radially against the container mouth during the course of the screwing-on process. In this way over-stretching and damage to the material of the sealing lip can be prevented.

8 Claims, 3 Drawing Figures



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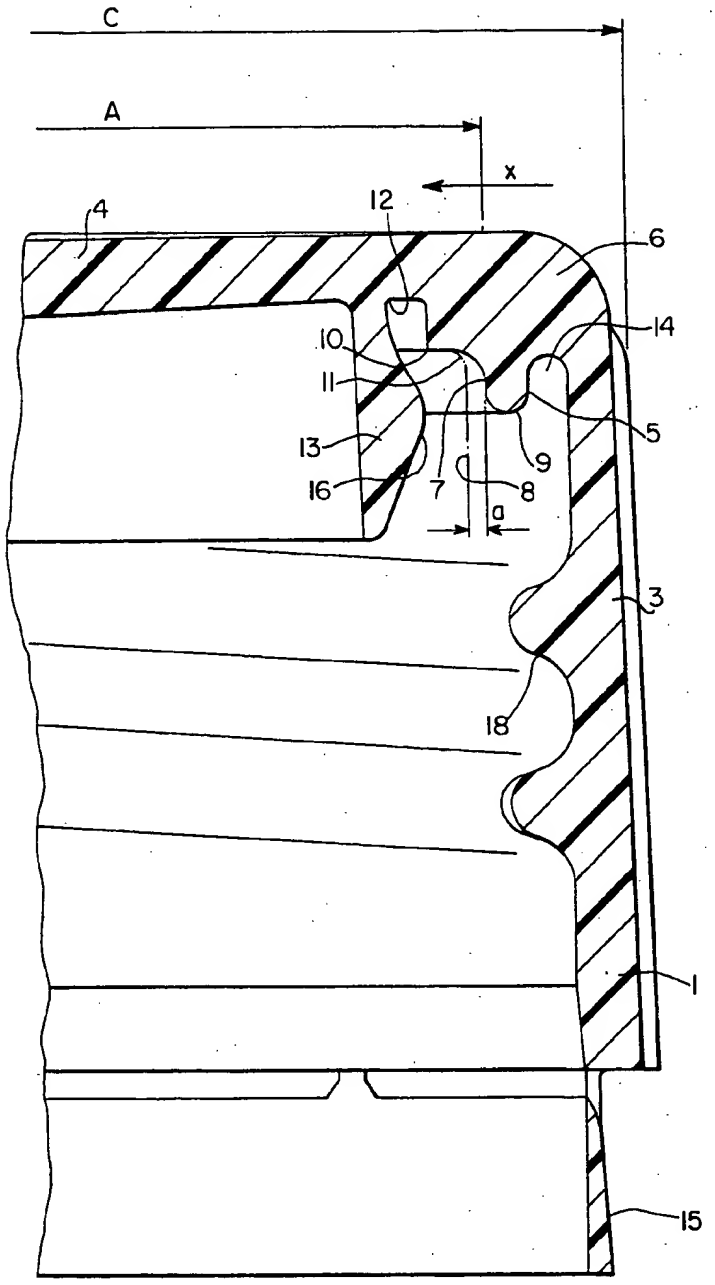

FIG. 1

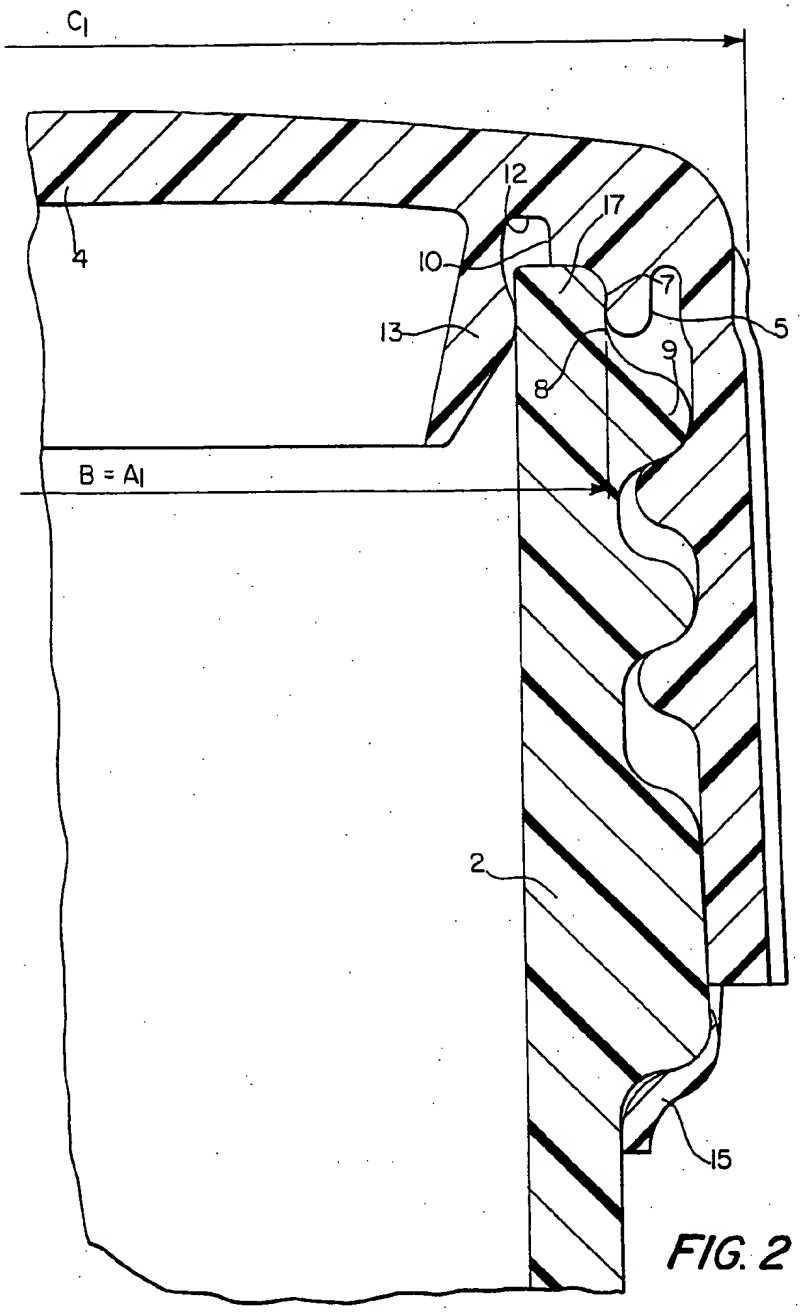

FIG. 2

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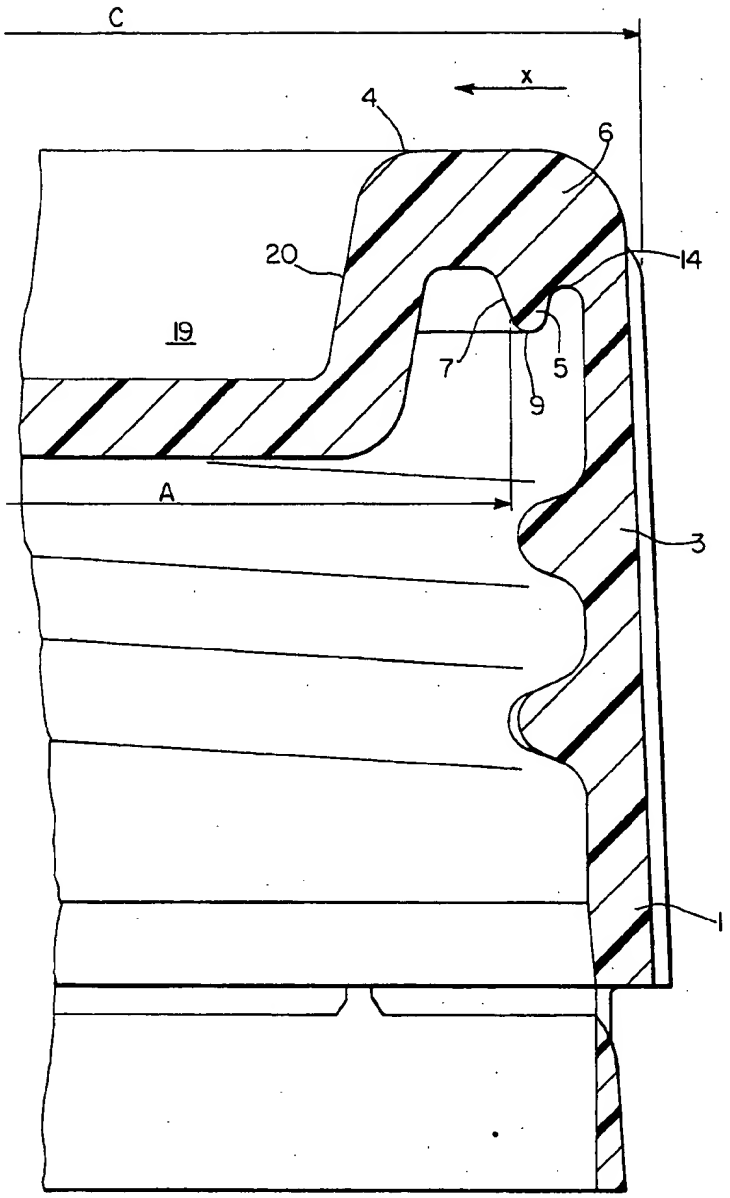

FIG. 3

SCREW-CAP FOR CONTAINER

The invention concerns a screw-cap made of plastic material for closing the mouth of a container, consisting of an approximately cylindrical cap side-wall with inner threading and a cap top, which is provided with a ring-shaped sealing lip to seal off the outer side of the mouth of the container in the area of this opening.

Screw-caps of this type are typically used for the closing of bottles containing soft drinks infused with carbon dioxide. With the ring-shaped sealing lip the result aimed for is a reliable seal which still remains effective even when the cap top bulges outward under the internal pressure within the container. Thus, by way of example, a screw-cap has become known from Swiss Patent No. 607 702, in which the cap top merges into a bevelled-off sealing ring which presses against the outer side of the container mouth. On the inner side of the bevelled-off sealing ring there is affixed a ring-shaped sealing lip which is pulled over the container mouth like a collar when screwed on, and therefore exerts a supplementary sealing action. In the German Patent No. 26 01 771 there is described a screw-cap in which the ring-shaped sealing lip is affixed inclined toward the inner side, acting in conjunction with a recessed groove encircling the container mouth.

In all the known embodiment forms the inner diameter of the ring-shaped sealing lip on the unscrewed screw-cap is somewhat smaller than the outer diameter of the container mouth right from the start. This is done to ensure that the initial tension of the sealing lip will force it against the container mouth in every case. A disadvantage of this configuration, however, is inherent in the fact that the sealing lip has to be stretched outward when it is screwed on, which requires a correspondingly greater amount of torque during the screwing-on process. Added to that, the sealing lip could be damaged when being screwed onto containers with sharp mouth edges. The stretching of the sealing lip moreover has the result that, when the screw-cap is screwed on, the sealing lip is subjected to very high and lasting tension. As particularly described in German Patent No. 26 01 771, this tension is even more increased by the effects of the internal pressure on the cap top. This tension, however, can result in cracks in the material or even fatigue fractures which, to state the obvious, can lead to leakage at such spots or even to explosion-like blasting loose of the screw-cap.

It is therefore the aim of the invention to produce a screw-cap of the type described in the introduction which it is possible to screw effortlessly onto the container mouth with slight torque and without danger of damage to the sealing lip, and in which the sealing lip is not subjected to any excessive tension after the screw-cap is screwed on, without thereby adversely affecting its sealing function.

This aim is achieved as per the invention in that, prior to the screw-cap being screwed on, the inner diameter of the sealing lip is greater than the outer diameter of the container mouth, in that the cap top has a clamping device inserted into the container mouth for the concentric compression of the cap top when the screw-cap is put on, and in that at least the cap top is elastically constructed in such a way that the sealing lip can be pressed against the outer side of the container mouth by means of the compression of the cap top and by means of the reduction in the outer diameter of the cap top when the clamping device is inserted into the container mouth.

In this configuration it should be obvious that the ring-shaped sealing lip is not stretched during the screwing-on of the screw-cap. On the contrary, the sealing lip is pressed against the outer side of the container mouth during the course of the screwing-on process. This function is based on the surprising discovery that, given a suitable elasticity in the cap top, it is possible to bring about a contraction of the cap top without much difficulty by means of an appropriate clamping device, and that the sealing lip can be moved with the aid of this contraction. It is obvious that this type of an arrangement has substantial advantages vis-a-vis the known state of the art. First of all, the sealing lip is pressed against the container mouth without stress by means of a radial contraction movement during the course of the screwing-on process. Particularly where sharp-edged container mouths are involved this system prevents the scratching of the sealing lip as it is forced inward. Over and above that, a better definition of the contact pressure of the sealing lip is possible with the aid of the clamping device. The sealing lip is not overstretched right from the beginning but reaches the required contact pressure, just adequate to maintain a reliable sealing function, only after the screw-cap has been screwed on. Furthermore, tensions created by internal pressure, by this means, are not able to lead to any damage to the screw-cap. With the aid of the compressible sealing lip it is additionally possible for the first time to achieve a ring-shaped sealing section on the inner side of the sealing lip. With the conventional types of sealing lips all that could be achieved was merely a sealing line, since a planar sectional contact by the sealing lip was not possible.

The invention can be made particularly advantageous if the clamping device is a ring-shaped inner seal whose inner diameter is greater than the inner diameter of the container mouth and which makes a sealing contact along a sealing line on the inner side of the container mouth. In this manner the clamping device usefully performs the function of a supplementary seal. The upper rim of the mouth of the bottle is thus sealed off both inside and outside, which substantially improves the sealing effect.

A good sealing effect is achieved if the inner side-wall of the sealing lip is constructed approximately cylindrically. In this manner the inner side of the sealing lip makes a flat sectional contact with the outer side of the container mouth. In specific types of application, however, it is useful if the inner side-wall of the sealing lip is joined to the cap top in a tapered form approximately like a truncated cone in shape. By this means, changes in the position of the sealing lip when compressed can be taken into account ahead of time, so that the inner side-wall of the sealing lip will make a flat sectional contact with the container mouth once again after the screw-cap has been screwed on.

A supplementary sealing section can be achieved by arranging to have a concentric ring surface within the sealing lip as a stop to limit the screwing-on movement. A limitation of the screwing-on process is particularly important since, by this means, the contraction movement can also be restricted. In this way too strong a compression of the sealing lip is prevented. The upper edge of the container mouth is pressed against the ring surface, so that a supplementary sealing occurs.

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A specially advantageous sealing effect is achieved if the lower edge of the sealing lip is arranged to be approximately at the same level as the sealing line. By this means the forces acting on the sealing line and on the sealing section of the sealing lip run approximately in the same plane, by which means a compression of the container rim is achieved.

The function of the clamping device can be improved by means of having it designed as an indentation of the cap top, whose sides facing the container mouth are tapered downward approximately in the shape of a truncated cone. By means of the indentation in the cap top the latter's outer rim section can, as should be obvious, be compressed more easily since, in the plane of the contractional movement, the cap top is indented in the centre. By means of the truncated-cone-shaped design of the indentation a leverage effect is achieved which, when the container mouth is forced against the truncated-cone-shaped side-walls, results in a compression of the outer rim section of the cap top. This type of design for the screw-cap is particularly of advantage in those cases where the screw-cap is made of a relatively rigid material, a material where the compression of the sealing lip having a disk-shaped cap top would only be possible by using a lot of force.

Especially good results with respect to the elasticity of the cap top are achieved if the screw-cap is made of polyethylene. With appropriate dimensioning of the screw-cap a compression of the sealing lip can be effected with this material without excessive use of force.

An embodiment example of the invention is illustrated in the drawings and will be described in greater detail below. The drawings show the following:

FIG. 1 - A partial cross-section of a screw-cap as per the invention, shown in greatly enlarged illustration

FIG. 2 - The screw-cap as per FIG. 1 screwed onto a container mouth

FIG. 3 - A modified embodiment example with an indented cap top.

As illustrated in FIG. 1, a screw-cap 1 consists of an approximately cylindrical cap side-wall 3 with internal threading 18 and a cap top 4. In the area of the junction point 6 between the cap top and the cap side-wall there is a sealing lip 5 affixed to the cap top. Immediately inside the sealing lip there is affixed a stop 10 to limit the screw-on movement. The ring-shaped stop merges into a radius 11 in the inner side-wall 7 of the sealing lip. Between the sealing lip 5 and the cap side-wall 3 there is an interspace 14, which corresponds in size approximately to the thickness of the sealing lip. In specific types of application the interspace 14 can also be omitted, so that the sealing lip 5 merges directly from the lower edge 9 into the outer wall and is therefore designed in the shape of a shoulder.

An inner seal 13, known as such, takes on the function of a clamping device for the compression of the sealing lip 5. The inner seal has an approximately convex outer configuration in cross-section with a sealing line 16 along which the inner seal makes contact with the inner wall of the container mouth. The sealing line 16 is located approximately on the same plane as the lower edge of the sealing lip 5. Between the inner seal 13 and the stop 10 there is located an undercut 12, in order to give a degree of flexibility to the inner seal as well.

As illustrated, the inner diameter A of the sealing lip 5 is greater than the outer diameter of the outer wall 8 (shown by a broken line) of the container mouth. By this means there is created a play clearance "a" between the container mouth and the sealing lip.

When the screw-cap is screwed on, the inner seal 13 is pressed together by the upper side of the container mouth 17. Since the cap top 4 has a certain amount of elasticity this also produces a contraction of the cap top, particularly in the outer area 6, in the direction of the arrow "X". By this means the play clearance "a" is eliminated and the sealing lip 5 makes sealing contact against the outer wall 8 of the container mouth. As shown in FIG. 2 this action also results in a measurable contraction of the outer diameter C of the cap side-wall 3. The original outer diameter C now has a reduced diameter C1, while the reduced inner diameter A1 of the sealing lip corresponds to the outer diameter B of the container mouth.

The cap top 4 bulges slightly outward because of the contraction movement, by which means the contact pressure of the sealing lip is strengthened even more.

The container mouth 2 may be made of either plastic, glass or some other material. The screw-cap 1 has on the bottom edge a security strip 15 which is intended to be shrink-fastened by means of heat-molding to a beading on the container mouth. The first time the screw-cap is unscrewed this security strip 15 is ripped apart.

In FIG. 3 a modified embodiment example is illustrated, in which the cap top 4 has an indentation 19. The side-wall 20 of the indentation is constructed in an approximately truncated cone shape, so that by this means there is formed an inclined contact surface for the container mouth. The side-wall 20 of the indentation 19 by this means creates a lever arm with which a contraction of the outer section 6 in the direction of the arrow "X" can be achieved in a particularly simple manner.

In the embodiment example as per FIG. 3 the inner wall 7 of the sealing lip 5 is also constructed in an approximately truncated cone shape, so that any kind of a position change of the sealing lip can be taken into account ahead of time. It goes without saying that the inner wall 7 of the sealing lip can also be adapted to whatever outer configuration the container mouth may have which, by way of example, may likewise be in the shape of a truncated cone. Obviously there are also other means possible that can be used as clamping devices to compress the cap top. Thus, one might for example attach a number of concentrically-arranged wedges to the cap top, whose tapered surfaces would run onto the inner edge of the container mouth and in this manner compress the cap top.

In an experiment with a standard-sized container mouth of the type 1716 of the Aluminium Company of America the following results were obtained: Dimensions prior to screwing on the cap:

Inner diameter A of the sealing lip	25.1 mm ± 0.1
Outer diameter C of the screw-cap	30.5 mm
Outer diameter B of the container mouth	24.95 mm
Outer diameter of the inner seal	22.6 mm ± 0.1
Length of the sealing lip from the stop 10 to the lower edge 9	1.15 mm +0/−0.1
Wall thickness of the cap top in the area of the undercut 12	about 1.2 mm

After screwing on the screw-cap with a torque of about 17 cm/kg an outer diameter C1 of 30.1 mm was measured on the screw-cap. The sealing, at an internal pressure of about 8 bar and an internal temperature of about 40° C. was still absolutely tight. A polyethylene

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plastic with the specification HDPE was used as material for the screw-cap.

I claim:

1. A screw-cap made of plastic material for closing the mouth of a container having a predetermined outer diameter, consisting of an approximately cylindrical cap side-wall with inner threading and a cap top, which is provided with a ring-shaped sealing lip to seal against the outer side of the mouth of the container in the area of the opening, characterized in that the inner diameter (A) of the sealing lip (5), before the screw-cap (1) is screwed on, is greater than the outer diameter (B) of the container mouth (2) against which it is to seal, in that the cap top (4) has a clamping device inserted into the container mouth for effecting radial contraction of the cap top when putting on the screw-cap, and in that at least the cap top is elastically constructed in such a way that the sealing lip is contracted inwardly and pressed against the outer side of the container mouth, as the clamping device is inserted into the container mouth, by means of the compression of the cap top and the radial contraction and reduction of its outer diameter.

2. A screw-cap as per claim 1, characterized in that the clamping device is a ring-shaped inner seal (13) whose outer diameter is greater than the inner diameter of the container mouth and which makes sealing contact with the inner side of the container mouth along a sealing line (16).

3. A screw-cap as per claim 2, characterized in that the inner wall of the sealing lip is constructed in approximately cylindrical form.

4. A screw-cap as per claim 2, characterized in that the inner wall of the sealing lip is tapered where it joins the cap top, approximately in the shape of a truncated cone.

5. A screw-cap as claimed in claim 2, characterized in that, on the inner part of the sealing lip there is affixed a concentric ring surface acting as a stop (10) to limit the screwing-on movement.

6. A screw-cap as claimed in claim 2, characterized in that the bottom edge (9) of the sealing lip is arranged to be at approximately the same level as the sealing line.

7. A screw-cap as per claim 1, characterized in that the clamping device is designed in the form of an indentation of the cap top, whose side facing the container mouth is tapered downward approximately in the shape of a truncated cone.

8. A screw-cap as claimed in claim 1 in combination with a container having an open-mouthed threaded neck with a circumferential sealing area on its outer side extending downwardly from the mouth, the outer diameter of the sealing area being less than the inner diameter of said sealing lip before the cap is screwed on.

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United States Patent [19]

Conti

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[11] 4,322,012

[45] Mar. 30, 1982

[54] **THREADED PLASTIC BOTTLE CAP**

[75] Inventor: **Vincent N. Conti**, West Hempstead, N.Y.

[73] Assignee: **Dairy Cap Corporation**, Jamaica, N.Y.

[21] Appl. No.: **148,555**

[22] Filed: **May 9, 1980**

[51] **Int. Cl.**³ **B65D 53/00**

[52] **U.S. Cl.** **215/344**; 215/252; 215/DIG. 1; 215/329

[58] **Field of Search** 215/252, 256, 329, 344, 215/DIG. 1

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Primary Examiner—George T. Hall

Attorney, Agent, or Firm—Pennie & Edmonds

[57] **ABSTRACT**

A plastic bottle cap for use in sealing bottles, the cap having a first annular sealing flange engaging the internal wall surface of the bottle and a second annular sealing flange engaging the top surface of the bottle neck. The second flange is constructed with a flexible tip which flexes relative to the remaining portion of the second flange as it is engaged by the top of the bottle neck to produce a flapper type seal. The cap further includes a tamper-proof ring at its bottom end which is automatically torn away as the cap is unthreaded from the bottle.

7 Claims, 4 Drawing Figures

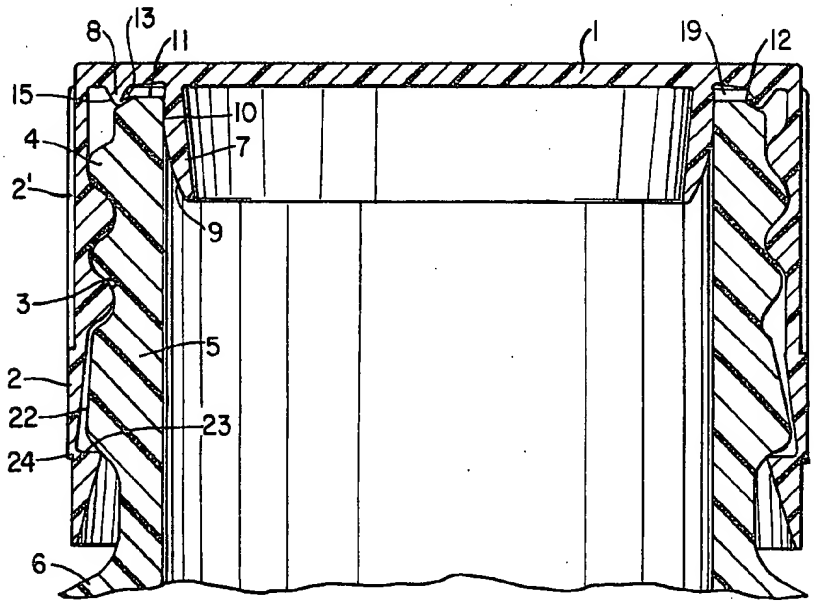

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FIG. 1

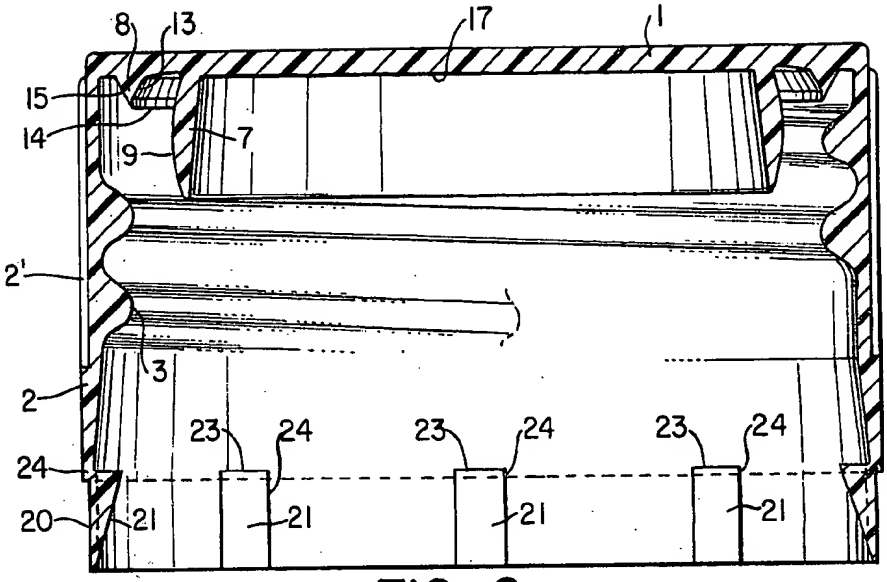


FIG. 2

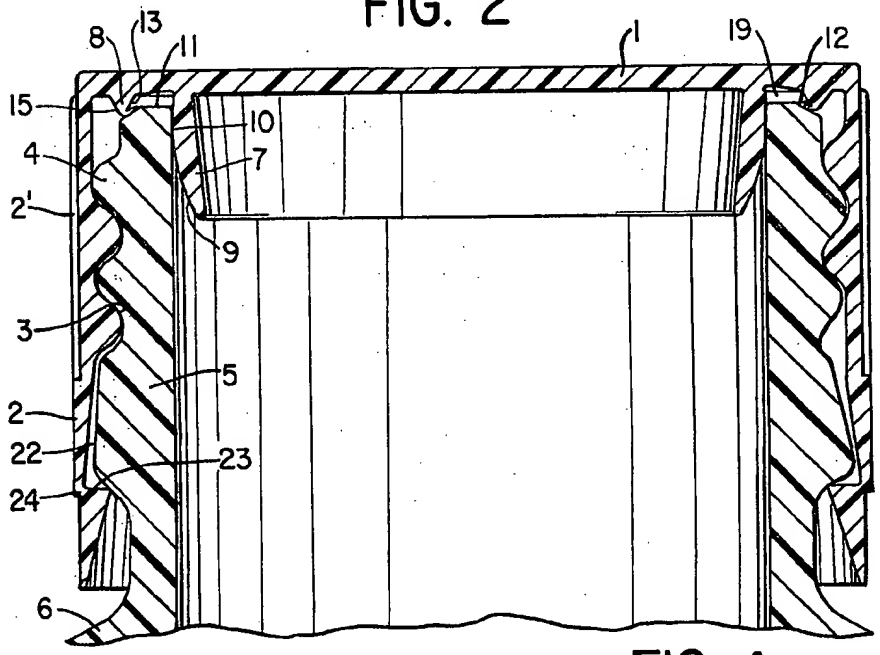


FIG. 3

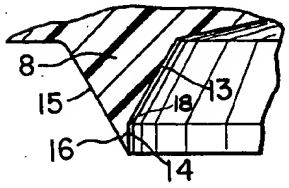
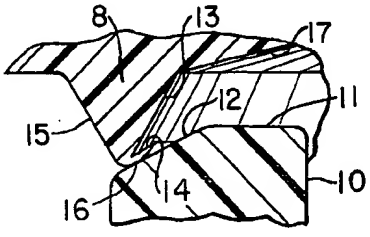


FIG. 4



THREADED PLASTIC BOTTLE CAP

TECHNICAL FIELD

The invention relates to a plastic threaded cap for bottles containing liquid under vacuum or pressure.

BACKGROUND ART

Bottle caps for carbonated beverages have for many years been constructed of metal. These caps are either crimped to the neck of the bottle or threaded onto the bottle. More recently the industry has turned to the use of plastic caps constructed either for a snap fit onto the bottle or threaded engagement with cooperating threads on the neck of the bottle. Plastic caps of the threaded construction are either designed for use with glass bottles or plastic bottles. The former use requires internal sealing configurations which can accommodate imperfections usually found in the top of the neck of glass bottles as resulting during their manufacturing or caused by rough handling. A typical plastic cap design for glass bottles is disclosed in U.S. Pat. No. 4,090,631. Although specifically constructed for glass bottles, these caps can also be used for plastic bottles. However, their construction is of such intricate design that the molding dies have to be correspondingly intricate. This in turn makes the molds subject to damage of the delicate parts during handling.

In constructing plastic caps as opposed to metal caps, more attention has to be given to the internal sealing flanges found on these caps so as to provide a suitable sealing of the contents in the bottle. This is more difficult with plastic caps because of their inherent physical characteristics which tend to permit the sealing effect to be lost during handling and storage of the bottles. In the use of plastic caps, there has also been encountered what is called the projectile effect which is caused by the cap providing too good a seal with the bottle neck. Where this occurs, the pressure within the bottle is not released until the cap is almost completely unthreaded. At this time, the internal pressure, instead of being released gradually, is released just at the time the cap is completely unthreaded and this causes the cap to be blown off the bottle with some force. This is particularly a problem where plastic caps are used with plastic bottles because plastic bottles do not have the usual inperfections that glass bottles have.

Although the imperfections in a glass bottle may promote problems as far as obtaining a good seal, these same imperfections help to eliminate the projectile effect since the pressure within the bottle can usually be released while the cap is still adequately threaded onto the bottle. The precision molding of plastic bottles does not produce these imperfections and thus the seal of the cap tends to be maintained until just before the cap is fully removed.

U.S. Pat. Nos. 3,441,161 and 4,143,785 disclose caps constructed of plastic and adapted to be attached to bottles either by snap fit or threaded connection. These patents, however, disclose no provisions for assuring harmless release of the pressure built up in the bottle. The bottle cap disclosed in U.S. Pat. No. 4,090,631 does disclose a cap which is constructed to release the pressure within the bottle before reaching the state where the cap would be subjected to being blown off by the internal pressure. As mentioned, however, this cap is of intricate construction as is the mold from which it is formed.

The caps disclosed in these patents also rely mainly on face-to-face contact of the cap with the opposed surfaces of the bottle for maintaining a seal. With plastic caps, simple surface contact does not at all times provide a seal which is adequate. This is mainly due to the absence of a resiliency of the seal at the cap bottle sealing interface.

DISCLOSURE OF THE INVENTION

In accordance with the teachings of the present invention, applicant has developed a threaded plastic cap of a construction which is particularly suited for effecting an efficient and stable seal while the bottle is being handled and stored. In addition, the seal is oriented so as to be released upon the initial unthreading of the cap from the bottle. The cap of the present invention is particularly suited for bottles constructed of plastic.

In construction, sealing is produced by two flanges depending downwardly from the top of the cap. One of these flanges effects a seal with the inner wall surface of the neck of the bottle while the second flange effects a seal on the top of the bottle neck around its outer periphery. This second flange is constructed to flex at its tip as it engages the top of the bottle neck so that this seal will always be resiliently biased against the top of the bottle neck as opposed to simply having the surface-to-surface contact found with prior art constructions. The two flanges are spaced from each other and with the intermediate area of the top of the cap provide a chamber which is isolated from the interior of the bottle. The void created by this chamber further assists in the sealing of the cap to the bottle.

Upon removal of the cap from the bottle, the second flange immediately releases its sealing effect while the sealing effectiveness of the inner seal is gradually reduced as the cap is unthreaded. This permits escape of pressure before the cap reaches a point where it will be blown off of the bottle.

The cap of the present invention further includes a tamper-proof ring secured at its lower end. This tamper-proof ring is constructed with cam surfaces for riding over a cooperating protuberance on the bottle neck until engaged underneath the protuberance as the cap is fully threaded onto the neck. The tamper-proof ring is frangibly connected to the remaining portion of the cap so that it will break upon unthreading.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an enlarged cross-sectional view of the cap of the present invention;

FIG. 2 is an enlarged cross-sectional view of the cap shown in FIG. 1 in fully threaded position on the neck of a bottle;

FIG. 3 is a greatly enlarged cross-sectional view of the outer annular seal of the cap in undistorted position; and

FIG. 4 is a greatly enlarged cross-sectional view of the outer sealing flange engaging the top of the bottle neck.

DETAILED DESCRIPTION OF THE INVENTION

The bottle cap as shown in FIGS. 1 and 2 includes a top wall 1, a cylindrical side wall 2 depending from the top wall and having an outer knurled surface 2' and a thread 3 on its internal surface. The thread is adapted to

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cooperate with an external thread 4 on the neck 5 of a bottle 6. For effecting sealing of the cap to the bottle, first and second flanges 7 and 8 are provided. Both of these flanges are annular in shape and extend downwardly from the top wall of the cap. The bottle cap shown in the drawings is a 28 mm cap and is constructed of suitable plastic such as polyethylene.

The first flange has an outer surface 9 which is convex in shape. The maximum diameter of this surface is greater than the inner diameter of the neck of the bottle so that, as the cap is threaded onto the bottle with this flange moving into the neck, it will flex radially inwardly to effect sealing against the inner surface 10 of the bottle neck.

The second sealing flange 8 is spaced radially outwardly of the first flange 7 and is oriented for engagement with the top surface 11 of the bottle neck at the outer periphery 12 thereof. This outer periphery is shown as being beveled. The second flange has a normal, generally triangular cross-sectional shape with inner and outer side walls extending downwardly from the top wall of the cap in a direction tapering toward each other. The inner wall includes an uppermost wall portion 13 extending toward the side wall 2 of the cap and a lowermost wall portion 14 extending axially of the side wall of the cap. The tip of the lowermost wall portion 14 intersects with the outer wall 15 of the flange to define a lower flange tip 16.

The outer wall 15 of the second flange is disposed at an angle of 45° with respect to the lowermost wall portion 14 of the inner wall. The uppermost wall portion 13 of the inner wall is, on the other hand, disposed at an angle of 30° with respect to the lowermost wall portion 14. The lower flange tip accounts for about ¼ of the height of the second flange from the inner surface 17 of the top wall of the cap. With a 28 mm cap, the total height of the second flange would be about 0.040 inches whereas the tip would be about 0.010 inches in length as measured in a direction extending downwardly from the inner surface 17. With a 28 mm cap, the inner wall surface 17 of the top which is disposed between the two flanges extends from the first flange toward the second flange in a direction downwardly from the top wall of the cap. The angle of inclination is about 7°.

The plastic material from which the cap is constructed has a flexibility characteristic whereby the lower flange tip 16 of the second flange is sufficiently flexible so that, as it is engaged by the top beveled periphery 12 of the bottle neck, it will bend radially inwardly about the point of intersection 18 of the uppermost and lowermost surfaces 13, 14. The final position of the lower flange tip is shown most clearly in FIG. 4. It will be noted that this tip in effect provides a flapper type seal which, due to the resiliency of the plastic material, maintains a tendency to straighten out. Thus, the tip maintains a seal against the beveled periphery 12 which is over and above that which would be created by a simple face-to-face contact between the flange and the periphery 12. With a 28 mm cap, a proper seal along the periphery 12 of the top of the bottle neck is assured by constructing the lowermost wall portion 14 with a diameter of about 0.020 of an inch less than the diameter of the neck of the bottle. The orientation of the second flange and, in particular, the lower flange tip is such that it will abut the beveled periphery 12 of the top of the neck to provide a space 19 between the top of the bottle neck and the inner surface 17 of the top wall of the cap when the cap is fully threaded onto the bottle neck. In some cases, the beveled periphery 12 may be at a different angle from that shown in FIG. 4 whereby the top 11 will be at a higher elevation. Even under these circumstances, if this angle is such as to raise the top 11 sufficiently so that it contacts the inner surface 17 of the top of the bottle cap, engagement will be made along the inclined surface adjacent its intersection with the uppermost portion 13 of the second flange. Accordingly, a space will still be provided between the top 11 of the bottle neck and the inner surface 17 of the top of the cap.

As shown in FIG. 2, the spacing of the top of the bottle neck and the inner surface of the top of the bottle cap is bounded radially by the points of engagement of the first and second flanges 7 and 8 with the cooperating surfaces of the bottle neck. This in turn defines an annular chamber and this chamber is isolated from the interior of the bottle. The chamber further assists in providing an adequate seal of the cap to the bottle.

In addition to the sealing flanges of the cap, a tamper-proof ring 20 is provided at the lower end of the side wall of the cap. This ring has circumferentially spaced inner tapered wall sections 21 extending downwardly in a direction away from the top wall of the cap and radially outwardly toward the side wall. The wall sections 21 provide cam surfaces for riding over the outer surface of the bottle and, in particular, over the protuberance 22 formed on the outer surface of the bottle as the cap is threaded onto the bottle neck. The tapered wall joins with a radially outwardly extending ledge 23 at the upper end thereof. This ledge is adapted to engage under the protuberance 22 as the cap is fully threaded onto the bottle neck.

The tamper-proof ring is connected to the lower end of the side wall of the cap by frangible elements 24. These frangible elements are of a thickness whereby the initial threading of the cap onto the bottle neck can be effected without destroying these members. However, once the ledge 23 engages underneath the protuberance on the bottle, unthreading of the cap will cause these frangible elements to break thus providing, for the ultimate purchaser of the bottle, a telltale indication of whether or not the cap has been tampered with.

With the unthreading of the cap from the bottle, it will be recognized from FIG. 2 that the initial unthreading will cause the second flange to unseal from the periphery surface 12. As unthreading is continued, the inner seal will become weaker as the first flange reverts to its normal position and this weakened seal will permit the harmless escape of built up pressure from within the bottle before the cap reaches a condition where it would be blown off of the bottle with any projectile effect. Not only does the cap of the present invention provide good sealing, the construction is such that molding of the cap is possible without requiring a mold of delicate configuration. Thus, the mold may be used over extended periods of time without concern that any fragile or delicate parts will be damaged during handling.

I claim:

1. In a bottle cap for use with a bottle having a threaded neck opening into the bottle, said cap being constructed of flexible plastic material and having a top wall, a cylindrical side wall depending from the top wall and a thread on the inner surface of the side wall for cooperating with the thread on the neck of the bottle, the improvement comprising:

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(a) a first annular sealing flange extending downwardly from said top wall for engagement with the wall surface of the bottle neck adjacent its opening into the bottle;

(b) a second annular sealing flange extending downwardly from said top wall outwardly of said first sealing flange for engagement with the top surface of the bottle neck, said second sealing flange normally having a generally triangular cross-sectional shape with inner and outer side walls extending downwardly from the top wall of the cap in a direction tapering toward each other and with the inner wall including an uppermost wall portion extending toward the side wall of the cap and a lowermost wall portion extending axially of the side wall of the cap until intersecting with the outer wall of the flange, said lowermost wall portion having an internal diameter slightly less than the outer diameter of the neck of said bottle and defining, with the adjacent portion of the outer side wall, a lower flange tip;

(c) said first and second sealing flanges being spaced from each other to seal against the cooperating surfaces of the bottle neck at spaced locations; and

(d) said lower flange tip of the second flange being of sufficient flexibility to bend radially inwardly as it engages the top surface of the bottle neck.

2. The improvement in the bottle cap according to claim 1 for a bottle having the top surface of the neck beveled at its outer periphery, wherein:

(a) the outer wall of the second flange is disposed at an angle of 45° with respect to the lowermost wall portion of the inner wall;

(b) the uppermost wall portion of the inner wall is disposed at an angle of 30° with respect thereto; and

(c) the lowermost wall portion of the inner wall amounts to about ¼ of the downward extension of the second flange.

3. The improvement in the bottle cap according to claim 2, wherein:

(a) the cap is constructed with the lowermost wall portion of the second flange having a diameter of about 0.020 of an inch less than the outer diameter of the neck of the bottle with which the cap is to be used.

4. The improvement in the bottle cap according to claim 3, wherein:

(a) the second flange is disposed to abut against the top surface of the bottle neck and to space the top surface from the inner surface of the top wall of the cap when the cap is fully threaded onto the bottle neck; and

(b) the spacing between the top surface of the bottle neck and the inner surface of the top wall of the cap is bounded radially by engagement of the first and second flanges with the cooperating surfaces of the bottle neck to define an annular chamber isolated from the interior of the bottle.

5. The improvement in the bottle cap according to claim 4, wherein:

(a) the lower surface of the top wall extends between the first and second flanges in a radially outwardly direction away from the top wall.

6. The improvement in the bottle cap according to claim 5, wherein:

(a) the radial outer surface of the first flange is convex in shape with the maximum diameter thereof being greater than the inner diameter of the neck of the bottle; and

(b) the first flange is flexible for flexing radially inwardly as the cap is threaded onto the bottle and the first flange inserted into the neck thereof so as to effect engagement of the outer surface of the first flange with the inner surface of the neck of the bottle.

7. The improvement in the bottle cap according to any one of claims 1-6, wherein:

(a) the cap further includes a tamper-proof ring at the end of the side wall for locking engagement with the exterior surface of the neck of the bottle upon threading of the cap onto the neck;

(b) said ring has an inner tapered wall extending downwardly in a direction away from the top wall of the cap and radially outwardly to provide a cam surface for riding over an outwardly extending protuberance on the neck of the bottle;

(c) said tapered wall joins with a radially outwardly extending ledge at the upper end thereof for engagement under the protuberance of the neck of the bottle after the cap is fully threaded thereon; and

(d) frangible means connect said ring and the side wall of the cap, said means being constructed to withstand outward flexing of the ring as its cam surface rides over the protuberance on the bottle neck and to break as the cap is unthreaded from the neck of the bottle.

* * * * *

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(54) **PLASTIC SCREW CLOSURE**

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(52) **U.S. Cl.** **215/252**; 215/253; 215/258; 215/344; 215/901

(58) **Field of Search** ..... 215/252, 211–214, 215/217, 223, 250, 253, 256, 258, 329, 330, 341, 342, 343, 344, 345, 354, DIG. 1; 220/265, 266, 268, 276, 288, 304

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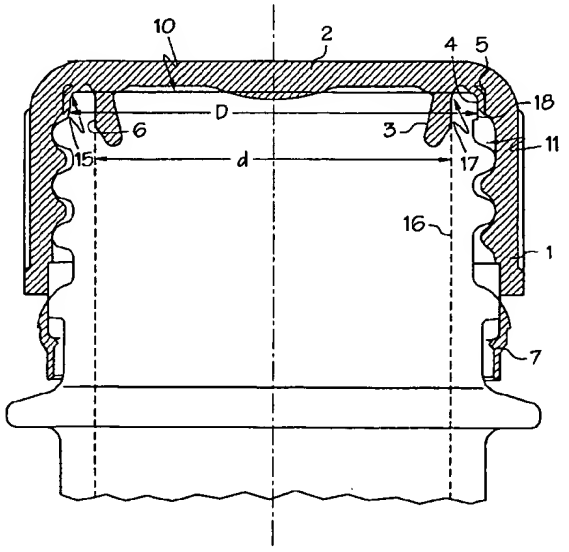
(57) **ABSTRACT**

A plastic screw closure for bottles comprising a cap having a substantially cylindrical peripheral portion (**1**) with an internal screw thread (**8**) for screwing onto an external screw thread (**11**) of a bottle neck (**10**), and with a disc-like top plate portion (**2**). A substantially cylindrical sealing strip (**4**) which extends axially from the inside of the top plate portion (**2**) has an outside diameter at least equal to the bottle neck's outside diameter (D) and an inside diameter ($2r_2$) smaller than the bottle neck's outside diameter (D). Inside the cylindrical sealing strip (**4**), a further, substantially cylindrical sealing olive-shaped button (**3**) is radially fitted, the outside diameter ($2R_1$) of which, at least in the area near the top plate and opposite the sealing strip (**4**), is larger than the inside diameter (d) of the bottle neck (**10**).

19 Claims, 2 Drawing Sheets



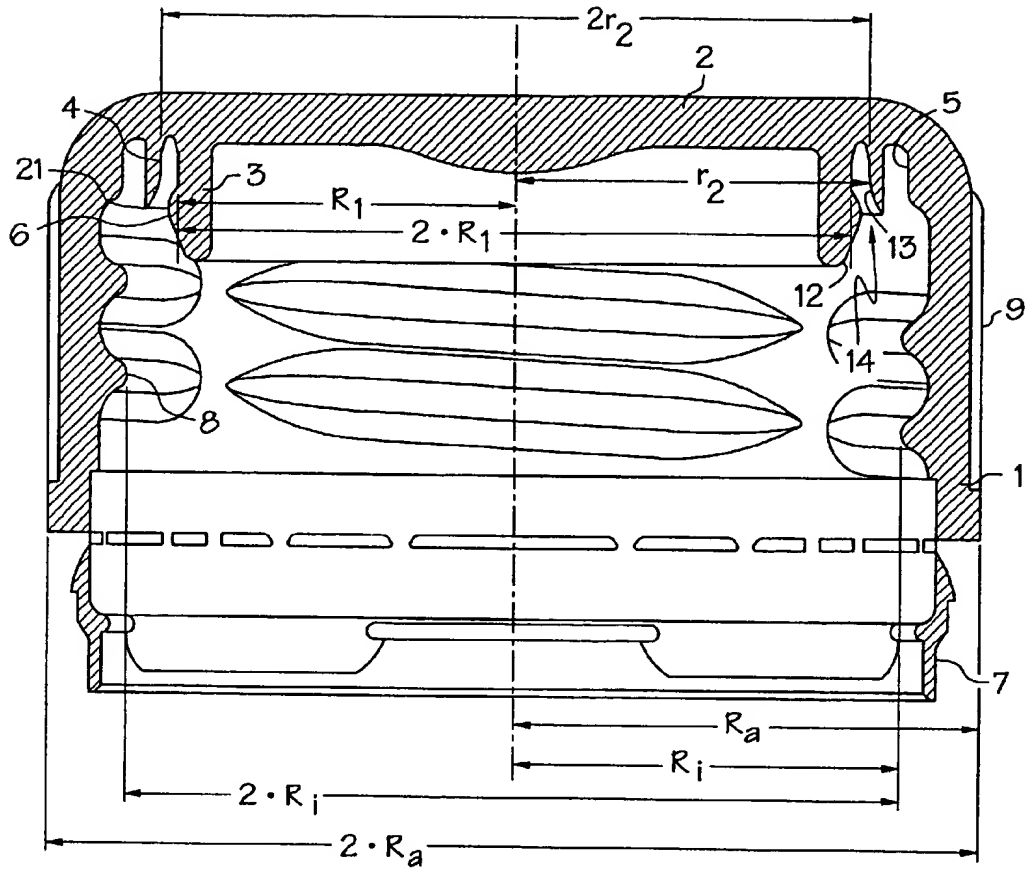


FIG. 1a

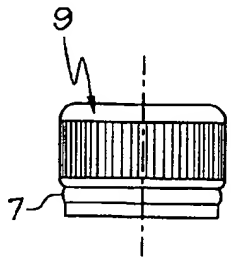


FIG. 1b

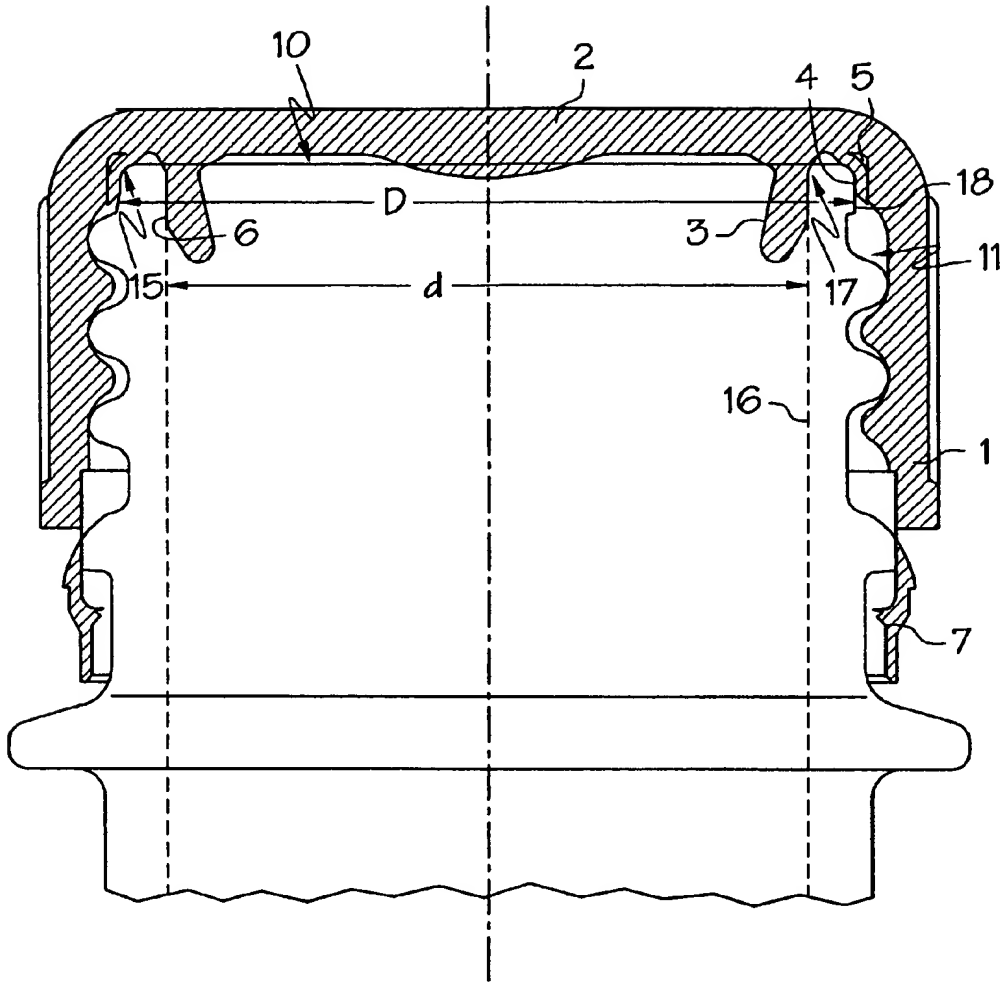


FIG. 2

PLASTIC SCREW CLOSURE

BACKGROUND OF THE INVENTION

The present invention concerns a plastic screw closure for bottles, comprising a substantially cylindrical peripheral portion with an internal screwthread for screwing onto the external screwthread of a bottle neck, and a top plate portion which is substantially in the form of a circular disc and a substantially cylindrical sealing strip which extends axially inwardly from the inside of the top plate portion and whose outside diameter approximately corresponds to the outside diameter of the bottle neck or is slightly larger and whose inside diameter is clearly smaller than the outside edge of the bottle neck.

A plastic screw closure of that kind for bottles is already known from DE 41 28 474.

The known plastic screw closure is intended for screwing onto the screwthreaded neck of bottles and is of such a design configuration that the substantially cylindrical strip bears from above and the outside onto the edge of the bottle neck and in so doing bears sealingly substantially along the upper outer rounded-off edge of the bottle neck or the mouth of the bottle. In that arrangement, the sealing strip is additionally also clamped between an outer substantially cylindrical bead or ridge and the bottle neck and is pulled and pressed into firm sealing engagement with the edge of the bottle neck. In principle such a closure could also be used for plastic bottles, for example PET-bottles.

In the case of multi-use bottles made of glass, the bottles generally and in particular also the bottle necks and mouth openings are visually checked before they are reused. In that respect however the possibility cannot be excluded, that damage to the edge of the bottle neck in the region where it comes into sealing engagement with the closure cap or sealing elements of the closure cap is overlooked, particularly if such damage is relatively small and inconspicuous. In principle that also applies for plastic bottles, in particular for the PET-bottles which are increasingly used. When dealing with plastic bottles, under some circumstances, due to the production procedure involved it is also necessary to reckon on rather larger manufacturing tolerances or damage occurring in the course of manufacture or handling. Minor damage, in particular in the form of small dents or grooves, can only be visually detected with difficulty. It can therefore certainly happen that bottles are filled and closed, when the edge of the bottle neck thereof has suffered minor damage, deformation or unevenness and irregularities caused by the manufacturing procedure and which are easily overlooked in a checking operation but which are sufficient to have an adverse effect on the sealing engagement between the edge of the bottle neck and sealing elements of the closure cap. That applies in particular if the interior of the bottle is under pressure, for example when using the bottles for carbonated drinks. A poor seal in the case of such bottles can have the result that gas escapes from the bottle and as a result causes a drop in pressure, which in turn results in outgassing of the carbon dioxide contained in the drink, which then after a storage time of some days or weeks, has substantially lost its carbon dioxide and correspondingly tastes stale.

WO 96/02430 already discloses a closure cap which is intended to ensure particularly good sealing engagement. Instead of a substantially cylindrical sealing strip, this known closure cap however has a substantially horizontally extending sealing strip which bears against the upper edge of the bottle neck, while in addition annular projections are provided at the bottom or the top plate portion of the closure cap and are intended to come into engagement with the sealing strip on the side thereof in opposite relationship to the edge of the bottle neck, and apply a linear sealing pressure to the sealing strip. The arrangement additionally also has an inner substantially cylindrical sealing olive, in which respect the term "olive" clearly defines the lower cross-section of that part which has an outwardly projecting region which is also intended to come into substantially linear engagement with the cylindrical inside surface of the bottle neck. Admittedly, the inside surface of a bottle neck is generally fairly precisely defined, at least in the case of PET-bottles, but it may certainly involve damage, so that the projection of the sealing olive cannot guarantee reliable sealing integrity, in spite of the substantially linear engagement of the sealing olive with the interior of the bottle neck. In addition, the sealing projection of the known closure is disposed at a considerable spacing relative to the point of attachment of the sealing plate portion to the top plate portion so that the arrangement does not afford very high elastic return or contact pressure forces in the region of the projection.

A substantially radially extending sealing plate admittedly partially covers over the outer, generally well-defined, rounded-off edge of the bottle neck which however can also be damaged, but just like the sealing olive it does not involve the inner, slightly rounded-off edge configuration of the edge portion of the bottle neck. These parts which are positioned in different ways relative to the axis of the closure define a blind hole-like depression with a considerable undercut configuration which gives rise to major problems in manufacture and in the operation of pressing out air, which is required in that context.

WO 96/26121 discloses a corresponding screw closure which, besides a substantially conically outwardly directed, peripherally extending sealing plate which is intended to come into engagement with the outer edge of the bottle neck, additionally also has an inner centering projection whose outside diameter however is somewhat smaller than the inside diameter of the bottle neck. That projection therefore does not come into sealing engagement with the interior of the bottle neck and in particular not with the upper inner edge of the bottle neck.

Because of the conical shape of the sealing plate, removal of such a closure from an injection moulding tool is a relatively difficult and complicated procedure. That applies even more in regard to the above-mentioned closure disclosed in WO 96/02430 in which the sealing plate extends parallel to the top plate portion radially inwardly virtually in one plane and, together with a further inwardly disposed sealing olive, defines a virtually closed hollow space or cavity.

The known closures therefore have at least in part problems in terms of manufacture and in particular removal from a mould and on the other hand they still do not guarantee absolutely sound sealing integrity in the event of minor damage or deformation of the edge of the bottle neck.

SUMMARY OF THE INVENTION

In comparison with that state of the art, the object of the present invention is to provide a plastic screw closure having the features set forth in the opening part of this specification, which still better prevents leaks in the event of slight damage or deformation of the edge of the bottle neck and which in addition if possible should be easily removable from a mould in order to facilitate manufacture with an injection moulding tool which is of the simplest possible structural configuration.

That object is attained in that the plastic screw closure, in addition to the features set forth in the opening part of this specification, includes the further features that provided radially within the cylindrical sealing strip is a further, substantially cylindrical sealing olive whose outside diameter at least in the region near the top plate portion and opposite to the sealing strip is larger than the inside diameter of a bottle neck for which the closure is intended.

While the outer sealing strip which is approximately of the configuration as in the case of known DE 41 28 474 thus provides for really good sealing integrity in respect of the upper outer edge of the bottle neck, there is additionally provided an inner sealing olive which additionally also seals off the inside surface at the upper edge of the bottle neck. The latter effect is achieved in that, in the region which is near the top plate portion and opposite to the sealing strip, that is to say in the region in which, when the closure is screwed onto a bottle, the upper edges of the bottle neck normally also lie, the sealing olive is still of a larger outside diameter than the inside diameter of the bottle neck or the edge of the bottle neck in that region, so that therefore the inner sealing olive is urged away radially inwardly and, when that happens, it bears sealingly against the inside surface of the edge of the bottle neck. The diameter conditions in regard to the sealing strip and the sealing olive necessarily mean that, in a given axial position and in particular in the axial region in which the upper edge of the bottle neck is disposed, the internal spacing between the sealing strip and the sealing olive must be smaller than corresponds to the thickness of the edge of the bottle neck. In that respect, a particularly preferred embodiment of the invention is one in which the internal spacing between the sealing strip and the sealing olive in the sealing region is less than two thirds and under some circumstances even less than half the thickness of the bottle neck. Since both, the sealing olive and the sealing strip preferably comprise the plastic material of the closure, they enjoy sufficient elasticity to be urged away by the edge of the bottle neck when the closure is fitted onto the bottle and is screwed fast, while however coming into very firm sealing engagement with the upper edge of the bottle neck, by virtue of the elastic return forces which occur in that case.

In addition, the preferred embodiment of the invention provides that, on its outside, the sealing olive has a shallow bead or ridge which in cross-section is approximately in the shape of an obtuse triangle.

In that respect, it is to be borne in mind that the fact that the inner projection is urged radially inwardly is equivalent to compression of the material which constitutes the sealing olive. The bead which is of a correspondingly larger outside diameter on the one hand comes into sealing engagement with the inside surface of the edge of the bottle neck and in so doing causes greater compression of the material constituting the sealing olive and thus an increase in the elastic return force which ultimately ensures reliable and secure sealing engagement.

At its free end the sealing olive is preferably rounded-off and/or bevelled so that, in the event of axial movement in the direction of the bottle neck, the sealing olive is also actually urged radially inwardly and does not rest on the edge of the bottle neck or is not urged radially outwardly.

In a similar fashion, in the preferred embodiment the sealing strip, at its free end, is also of a rounded-off and/or bevelled shape so that upon axial movement in a direction towards the bottle neck it is spread radially outwardly when it comes into engagement with the edge of the bottle neck.

Overall the preferred alternative configurations of the sealing strip and the sealing olive can be characterised to the effect that deviations thereof from a precise hollow-cylindrical shape are essentially limited to the outside wall of the projection and the inside wall of the sealing strip. In that respect, in the preferred embodiment, the olive is approximately twice as thick and at least 50% longer (in the axial direction) than the sealing strip. Preferably, the axial length of the sealing olive is even about twice the axial length of the sealing strip. By virtue of that relatively massive configuration of the sealing olive, in the preferred embodiment of the invention, the deviation of the outside diameter of the sealing olive from the diameter of the edge of the bottle neck, at any event in the region where the sealing action essentially occurs, is less than the corresponding deviation of the inside diameter of the sealing strip from the outside diameter of the edge of the bottle neck as the sealing strip is thinner and shorter and can thus be more easily elastically stretched and moved away.

Preferably the outside surfaces of the sealing olive and the inside surface of the sealing strip extend substantially parallel over the axial extent of the sealing strip, that is to say, over the length of the sealing strip, there is a substantially constant internal width between the sealing olive and the sealing strip, and the outside surface of the sealing olive extends, particularly at the axial height of the end of the sealing strip, parallel to the bevelled and round-off shape thereof. In cross-section therefore the hollow space or cavity which is formed between the sealing olive and the sealing strip is of a narrow configuration which is slightly concavely curved and rounded-off at the top, and the hollow space or cavity is open at its lower end and closed at the top. In that arrangement, in terms of cross-section, the hollow space or cavity which extends in a slightly curved configuration from bottom to top, is of a substantially constant width and decreases in width only at its upper closed and rounded-off end, while the upper portion, with respect to the axis of the closure, is almost cylindrical and the lower portion enlarges outwardly in a conical configuration. The axial length of the hollow space or cavity which is markedly narrower than the thickness of the associated bottle neck is defined by the length of the outer sealing strip which is in turn relatively short so that, in the condition of being screwed onto a bottle neck, it thus just completely embraces the outer, rounded-off edge of the bottle neck. That means that the narrow hollow space or cavity between the sealing olive and the sealing strip remains axially correspondingly short, which facilitates the manufacturing operation and also makes the configuration of a suitable injection moulding tool simpler. In specific terms, this hollow space or cavity is of an axial depth (corresponding to the axial length of the sealing strip) of less than 4 mm, preferably less than 3 mm and in particular about 2 to 2.5 mm.

The free end of the peripheral portion of the screw closure is preferably integrally provided with a guarantee or anti-tamper and tear-off band. As also generally, the closure in the preferred embodiment is produced in one piece from a homogenous plastic material using injection moulding. The substantially cylindrical shapes of the sealing olive and the sealing strip and the short axial length thereof permit relatively easy and simple removal of the moulded article from the mould and also allow the manufacturing tool to be of a correspondingly simple shape.

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantages, features and possible uses of the present invention will be clearly apparent from the following

description of a preferred embodiment and the accompanying drawings in which:

FIG. **1***a* shows the screw closure according to the invention in a sectional view containing the axis, on an enlarged scale,

FIG. **1***b* shows a side view of the screw closure of FIG. **1***a*, approximately in original size, and

FIG. **2** shows the closure of FIG. **1** in the same axial sectional plane but in a condition of being screwed onto a bottle neck.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1***a* shows the screw closure according to the invention, in a longitudinal section containing the axis thereof. The screw closure substantially comprises a cylindrical peripheral portion **1** with a top plate portion **2** which is integrally joined thereto and which is approximately in the shape of a circular disc. An anti-tamper and tear-off band **7** is also attached to the free end of the cylindrical peripheral portion **1**, also in one piece with the peripheral portion **1**. The anti-tamper and tear-off band **7**, by unscrewing of the screw cap, is torn open by a bottle or tears off the peripheral portion **1** and thus identifies that the bottle has already been opened.

The cylindrical peripheral portion **1** has an internal screwthread **8** which is interrupted in portions thereof, while on its outside it has gripping knurling **9** which is intended to make it easier to apply torque when gripping the closure cap with the fingers.

The two elements which afford sealing integrity with the bottle neck are the cylindrical sealing strip **4** which extends in an annular configuration around the closure and the sealing olive **3** which also extends in an annular configuration and parallel to the sealing strip **4**. As can be seen, the outside wall of the sealing strip **4** and the inside wall of the cylindrical sealing olive **3** extend straight in the cross-sectional view and are thus fairly precisely cylindrical. The inside wall of the cylindrical sealing strip **4** having an inside diameter $2r_2$, which clearly smaller than an outside diameter D of the bottle neck (FIG. **2**), extends parallel to the axis of the closure, only over a relatively short portion, and is then rounded-off in the direction of the free end **21** and extends inclinedly outwardly. The outside wall of the cylindrical olive **3** has a bead or ridge **6** which is shallow in cross-section, approximately in the form of an obtuse-angled triangle, wherein the obtuse angle of the obtuse-angled triangle defines the maximum outside diameter of the bead or projection **3** and axially, approximately coincides with the free end **21** of the sealing strip **4**. Then, towards the top plate portion **2**, the outside wall of the cylindrical sealing olive **3**, starting from the bead or ridge, extends approximately parallel to the end portion which extends in an inclined and rounded-off configuration, before it again extends approximately parallel to the axis and then follows an arcuate path to blend into the inside wall of the sealing strip **4**. The mutually facing surfaces of the sealing strip **4** and the sealing olive **3** extend parallel over the greatest part of the axial length of the sealing strip **4**.

The axial length of the sealing olive **3** is greater than the axial length of the sealing strip **4** by at least 50% and preferably by about 100%.

The deviations of the hollow-cylindrical shape of the sealing olive **3** and the sealing strip **4** are substantially limited to the outside wall **12** of the sealing olive and the inside wall **13** of the sealing strip **4**.

In cross-section therefore the hollow space or cavity **14** which is formed between the sealing olive **3** and the sealing strip **4** is of a narrow configuration which is slightly concavely curved and rounded-off at the top, and the hollow space or cavity is open at its lower end and closed at the top. The internal spacing $(r_2–R_1)$ between the sealing strip **4** and the sealing olive **3** in the sealing region is less than two thirds and optionally less than half the thickness |D–d| (FIG. **2**) of the bottle neck **10**. In that arrangement, in terms of cross-section, the hollow space or cavity **14** which extends in a slightly curved configuration from bottom to top, is of a substantially constant width and decreases in width only at its upper closed and rounded-off end, while the upper portion, with respect to the axis of the closure, is almost cylindrical and the lower portion enlarges outwardly in a conical configuration. The axial length of the hollow space or cavity which is markedly narrower than the thickness of the associated bottle neck is defined by the length of the outer sealing strip **4** which is in turn relatively short so that, in the condition of being screwed onto a bottle neck, it thus just completely embraces the outer, rounded-off edge **15** (FIG. **2**) of the bottle neck. That means that the narrow hollow space or cavity **14** between the sealing olive **3** and the sealing strip **4** remains axially correspondingly short, which facilitates the manufacturing operation and also makes the configuration of a suitable injection molding tool simpler. In specific terms, this hollow space or cavity **14** is of an axial depth (corresponding to the axial length of the sealing strip) of less than 4 mm, preferably less than 3 mm, and in particular about 2 to 2.5 mm.

FIG. **1***b* shows a side view of the closure in approximately natural size. The drawing clearly shows the knurling **9** on the outside of the screw cap, which is intended to make it easier to screw the closure on and off, as well as the lower anti-tamper and tear-off band **7**. In other respects the closure is shown in FIGS. **1** and **2** precisely true to scale, the dimension R_a being somewhat less than 31 mm. Because the view is shown to scale, that dimension can be used as a basis for exactly deriving all other dimensions, and the absolute and relative dimensions of all elements are disclosed in the Figures, by virtue of the views being true to scale. It will be appreciated however that the invention is not limited to observing the absolute and relative dimensions of the individual elements of the closure cap.

The free end of the sealing olive **3** is also clearly rounded-off so that, when the free end of the olive **3** meets a bottle neck, the free end of the sealing olive **3** slides away and is urged inwardly. FIG. **2** shows the plastic screw closure once again in the same sectional plane, but in the condition of the internal screwthread **8** being screwed fast onto an external screwthread **11** of a bottle neck **10**. It will be seen that the sealing olive **3** is urged inwardly by virtue of its rounded-off free end coming into engagement with the end face of the bottle neck **10**, while the bead **6** bears against the inner cylindrical surface **16** of the bottle neck. It will be seen that in this case the cylindrical olive **3** is displaced inwardly and compressed so that a corresponding elastic return force is produced, which provides for a firm sealing engagement by bearing sealingly against the inside surface **16** of the inner edge **17** of the bottle neck **10**.

At the upper outer edge **13** of the bottle neck, sealing integrity is afforded by virtue of engagement with the sealing strip **4** which, when its free rounded-off or bevelled end comes into engagement with the end face of the bottle neck, is displaced outwardly and is then clamped between the outside surface **18** of the bottle neck and a cylindrical bead **5** and is drawn by the bead **5**, around the upper outer edge

13 of the bottle neck. The bead **5**, as shown in FIG. **1***a* is provided at the transition between the top plate portion and the peripheral portion of the closure cap and has a substantially cylindrical inside surface having a diameter of $2R_i$, of which is at most equal to and preferably somewhat smaller than the sum of the diameter D of the bottle neck and double the thickness of the sealing strip **4**. In regard to the details of the good sealing engagement achieved thereby, attention is directed to DE 41 28 474. As the sealing olive **3** is markedly thicker and preferably approximately twice as thick (without having regard to the bead) as the sealing strip **4**, the preferred embodiment of the invention provides that the outside diameter $2R_1$ of the sealing olive in the region in which it comes into engagement with the upper edge **17** of the bottle neck involves a smaller difference in relation to the inside diameter d of the edge of the bottle neck in that region than the sealing strip **4** with its inside surface relative to the outside edge of the neck of the bottle as, with the same force acting, the sealing strip **4** is more easily deformable than the sealing olive **3**. This can also be clearly seen from FIG. **2** and by the comparison with FIG. **1**. The difference in diameter $|d-2R_1|$ between the sealing olive and the inner edge of the bottle neck, when the closure is not screwed onto a bottle neck, is only about a third to a quarter of the difference in diameter $D-2r_2$ between the inside surface of the sealing strip and the outer edge of the neck of the bottle. As such, the deviation $|2R_i-d|$ of the outside diameter $2R_1$ of the sealing olive **3** from the inside diameter d of the bottle neck is markedly less than the deviation $|2r_2-D|$ of the inside diameter $2r_2$ of the sealing strip **4** from the outside diameter D of the bottle neck. The ratio of the deviations is at least 1:2, preferably 1:3 to 1:5.

Since both, the sealing olive and the sealing strip preferably comprise the plastic material of the closure, they enjoy sufficient elasticity to be urged away by the edge of the bottle neck when the closure is fitted onto the bottle and is screwed fast, while however coming into very firm sealing engagement with the upper edge of the bottle neck, by virtue of the elastic return forces which occur in that case.

The closure according to the invention provides that both the upper outer edge and also the inside surface of the mouth of the bottle neck is gripped and sealed between two mutually oppositely disposed sealing elements. The arrangement thus affords two virtually equivalent seals which are independent of each other so that, in the event of damage, deformation or deviations in tolerances of the upper edge of the bottle neck having remained unnoticed, there is still a relatively great probability that at least one of the two seals ensures adequate sealing integrity, as it is improbable that damage or deformation which involves both the upper outer edge and also the upper inside surface of the edge of the bottle neck remains unnoticed.

In addition the bottle neck applies to the two sealing elements, radially opposed forces which substantially neutralise each other. That ensures that the top plate portion (or end portion of the closure cap) which carries those forces in the case of conventional seals which are in contact at one side does not yield to those forces due to a slow flow or creep phenomenon, so that the sealing engagement does not become gradually weaker.

What is claimed is:

1. A plastic screw closure intended for sealing a bottle with a threaded bottle neck **(10)** having an outside diameter (D), an inside diameter (d), a thickness (1/2|D–d|) defined therebetween, an upper outer edge, and an inner surface, said screw closure, before being secured on the bottle neck to which said closure is to be applied, comprising:

a top plate portion **(2)** which is substantially in the form of a circular disc;

a substantially cylindrical peripheral portion **(1)** extending from said top plate portion, said peripheral portion having a screwthread **(8)** adapted to cooperate with the threaded bottle neck and a substantially cylindrical bead **(5)** adjacent said top plate portion;

a substantially cylindrical deformable sealing strip **(4)** extending axially from said top plate portion **(2)** inward of said bead and having an inside diameter **(2r2)** which is smaller than the outside diameter (D) of the thread bottle neck; and

a substantially cylindrical sealing olive **(3)** extending axially from said top plate portion **(2)** inward of said deformable sealing strip **(4)** and having, at least at a portion substantially opposite said deformable sealing strip, an outside diameter **(2R1)** greater than the inside diameter (d) of the threaded bottle neck **(10)**,

wherein when said closure is fitted onto the threaded bottle neck:

said sealing olive is adapted to radially deform inwardly and seal at least substantially along the inner surface of the threaded bottle neck,

said deformable sealing strip is adapted to radially deform outwardly at least as large as or greater than the radial inward deformation of said sealing olive and seal at least substantially along the upper outer edge of the threaded bottle neck, and

said cylindrical bead is adapted to press said sealing strip against the threaded bottle neck.

2. The plastic screw closure according to claim **1**, wherein a first deviation is less than a second deviation, said first deviation defined by the absolute difference between said outside diameter $(2R_1)$ of said sealing olive **(3)** and the inside diameter (d) of the bottle neck **(10)**, and said second deviation defined by the absolute difference between said inside diameter $(2r_2)$ of the sealing strip **(4)** and the outside diameter (D) of the bottle neck **(10)**.

3. The plastic screw closure according to claim **2**, wherein a ratio between said first and second deviations is at least 1:2.

4. The plastic screw closure according to claim **2**, wherein a ratio between said first and second deviations is from about 1:3 to about 1:5.

5. The plastic screw closure according to claim **1**, wherein a spacing (r_2-R_1) between said sealing strip **(4)** and the sealing olive **(3)** is less than half the thickness of the bottle neck **(10)** in the region in which said closure comes into sealing engagement with the bottle neck.

6. The plastic screw closure according to claim **1**, wherein a spacing (r_2-R_1) between said sealing strip **(4)** and the sealing olive **(3)** is less than two thirds the thickness of the bottle neck **(10)** in the region in which said closure comes into sealing engagement with the bottle neck.

7. The plastic screw closure according to claim **1**, wherein said sealing olive **(3)** includes, on an outside wall thereof, a shallow bead **(6)** with a cross-section of an obtuse-angled triangle.

8. The plastic screw closure according to claim **7**, wherein said sealing olive **(3)** at its free end, extends in cross-section in a rounded-off and/or beveled configuration which permits said sealing olive to be urged radially inwardly upon axial movement of said screw closure onto the bottle neck.

9. The plastic screw closure according to claim **1**, wherein said sealing strip **(4)** extends in a rounded-off and/or beveled configuration which permits said sealing strip **(4)** to be urged radially outwards upon axial movement of said screw closure onto the bottle neck.

10. The plastic screw closure according to claim 1, wherein deviations in shape between said substantially cylindrical sealing olive (3) and said substantially cylindrical sealing strip (4) are substantially limited to an outside wall (12) of said sealing olive and an inside wall (13) of said sealing strip.

11. The plastic screw closure according to claim 10, wherein said inside wall (13) of said sealing strip (4) and said outside wall (12) of said sealing olive (3) extend substantially parallel over the greater part of the axial length of the sealing strip.

12. The plastic screw closure according to claim 1, wherein the axial length of said sealing olive (3) is greater than the axial length of the sealing strip (4) by at least 50 percent.

13. The plastic screw closure according to claim 1, wherein the axial length of said sealing olive (3) is greater than the axial length of the sealing strip (4) by at about 100 percent.

14. The plastic screw closure according to claim 1, wherein the mean thickness of said sealing olive (3) is at least twice the thickness of said sealing strip (4).

15. The plastic screw closure according to claim 14, wherein said closure is produced in one piece from a homogenous material.

16. The plastic screw closure according to claim 1, wherein said closure is produced in one piece from a homogenous material.

17. The plastic screw closure according to claim 1, wherein said peripheral portion (1) at a lower edge includes an anti-tamper and tear-off band (7).

18. The plastic screw closure according to claim 1, wherein said surface diameter ($2R_i$) of said bead (5) is smaller than the sum of the outside diameter (D) of the bottle neck and double the thickness of said sealing strip (4).

19. A plastic screw closure intended for sealing a bottle with a threaded bottle neck (10) having an outside diameter (D), an inside diameter (d), a thickness (1/2|D−d|) defined therebetween, an upper outer edge, and an inner surface, said screw closure, before being secured on the bottle neck to which said closure is to be applied, comprising:

a top plate portion (2) which is substantially in the form of a circular disc;

a substantially cylindrical peripheral portion (1) extending from said top plate portion, said peripheral portion having a substantially cylindrical bead (5), adjacent said top plate portion, and a screwthread (8) adapted to cooperate with the threaded bottle neck;

a substantially cylindrical deformable sealing strip (4) extending axially from said top plate portion (2) inward of said bead (5) and having a free end and an inside diameter (2r2) which is smaller than the outside diameter (D) of the threaded bottle neck; and

a substantially cylindrical sealing olive (3) extending axially from said top plate portion (2) inward of said deformable sealing strip (4) and having, at least at a portion substantially opposite said free end of said deformable sealing strip, an outside diameter (2R1) greater than the inside diameter (d) of the threaded bottle neck (10).

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